NATIONAL EDITION

NOVEMBER
1947

CHEMICAL ENGINEERING

WITH CHEMICAL & METALLURGICAL ENGINEERING

This issue features: Eighth *Chemical Engineering* Award to Merck for work on streptomycin, Southwestern process industry developments, new stationary mercury cell, Sorbitol from corn sugar by catalytic reduction, continuous viscosity measurement, equipment cost indexes for process industries, calculation of high vacuum systems, piping cost estimation, preview of trends at New York Chem show, glassine paper pictured flowsheet.

McGRAW-HILL PUBLICATION

"Right Away is Right!"

THERE was no delay in procuring the special fitting shown above. It was fabricated on the spot, when needed, with a standard TUBE-TURN welding elbow taken from the nearby TUBE-TURN distributor's stock.

Thus, TUBE-TURN welding fittings and the welder's art save time and money on special applications in countless variations.

TUBE-TURN welding fittings are particularly suitable for pipe fabrication because of the uniform wall thickness and full circularity which allows them to be successfully cut and joined in special ways. They are uniform from fitting to fitting. Order two or a thousand TUBE-TURN welding fittings of the same size and part number—they will be dimensionally alike.

The extent of the TUBE-TURN line is a big advantage in solving many different problems of pipe engineering and fabrication. There are more than 4000 different types and sizes of TUBE-TURN welding fittings and flanges. They come in many metals and alloys. For details, contact your nearest TUBE-TURN distributor. For his name, write to—

TUBE TURNS, INC., LOUISVILLE 1, KENTUCKY

District Offices at New York, Philadelphia, Pittsburgh, Detroit, Chicago, Houston, Tulsa, San Francisco, Los Angeles

TUBE-TURN tt *Welding Fittings and Flanges*

CHEMICAL ENGINEERING

with CHEMICAL & METALLURGICAL ENGINEERING

Volume 54 Number 11

NOVEMBER 1947

S. D. KIRKPATRICK.....*Editor*
JAMES A. LEE.....*Managing Editor*
THEODORE R. OLIVE.....*Associate Editor*
HENRY M. BATTERS.....*Market Editor*
LESTER B. POPE.....*Assistant Editor*
RICHARD W. PORTER.....*Assistant Editor*
EDMOND C. FETTER.....*Assistant Editor*
RICHARD F. WARREN.....*Assistant Editor*

EDITORIAL REPRESENTATIVES
JOHN R. CALLAHAM.....*San Francisco*
JAMES F. COSGRAVE.....*San Francisco*
J. V. HIGHTOWER.....*Houston*
EARLE MAULDIN.....*Atlanta*
R. S. McBRIDE.....*Washington*
E. S. STATELER.....*Chicago*

M. A. WILLIAMSON.....*Publisher*

DISTRICT MANAGERS
E. H. BEDELL.....*New York*
R. G. FREDERICK.....*New York*
FRED GRANT.....*Cleveland*
L. A. CUNNINGHAM.....*Chicago*
W. D. BOYD.....*Boston*
E. M. SCHELLENGER.....*Philadelphia*

JOHN CHAPMAN.....*World News Director*

Published monthly. Price 50 cents per copy. Publication office, 99-129 North Broadway, Albany 1, N. Y. Address communications about subscriptions to J. E. Blackburn, Jr., Vice-President (for circulation operations). Chemical Engineering, with Chemical & Metallurgical Engineering. Subscription rates—United States and possessions: $5 per year, $8 for two years, $10 for three years; Canada: $6 per year, $10 for two years, $12 for three years (payable in Canadian funds); Pan American countries: $10 for one year, $16 for two years, $20 for three years; all other countries, $15 per year, $30 for three years. Please indicate position and company connection on all subscription orders. Chemical Engineering solicits subscriptions only from executives and engineers in companies in which chemical engineering and processing form an important part of the total operation, and from consultants and laboratories whose field includes such process industries. Entered as second-class matter September 3, 1936, at Post Office at Albany, N. Y., U.S.A., under act of March 3, 1879.

Copyright 1947 by McGraw-Hill Publishing Company, Inc.—all rights reserved.

Branch offices: 520 North Michigan Avenue, Chicago 11; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London W.C. 2; Washington 4; Philadelphia 3; Cleveland 15; Detroit 26; St. Louis 8; Boston 16; Los Angeles 14; Atlanta 3; Pittsburgh 22; Houston 2.

Return Postage Guaranteed.

McGRAW-HILL PUBLISHING CO., INC.

JAMES H. McGRAW
Founder and Honorary Chairman

Publication Office
99-129 North Broadway, Albany 1, N. Y.

Editorial and Executive Offices
330 West 42nd Street, New York 18, N. Y.

JAMES H. McGRAW, Jr., *President;* CURTIS W. McGRAW, *Senior Vice-President and Treasurer;* JOSEPH A. GERARDI, *Secretary;* NELSON BOND, *Director of Advertising;* EUGENE DUFFIELD, *Editorial Assistant to the President;* and J. E. BLACKBURN, Jr., *Director of Circulation.*

Member A.B.P. Member A.B.C.
Cable Address McGRAW-HILL, New York

In This Issue

Eighth Biennial Chemical Engineering Award.....91
By S. D. KIRKPATRICK
For Distinguished Service to Humanity.....91
A Case Study in Biochemical Engineering.....94
The Story of Streptomycin.....97

Continuous Rayon Spinning Process.....103

New Skyline for Old Southwest.....104
By J. V. HIGHTOWER

New Mercury Cell Makes Its Bow.....108
By W. C. GARDINER

Viscosity Measurement—Oil Industry's Tool.....113
By D. J. POMPEO

Sorbitol from Corn Sugar by Catalytic Reduction.....114
By RICHARD W. PORTER

Benzol: How It's Chlorinated.....118
By JAMES A. LEE

How "N" System Simplifies Piping Cost Estimation.....121
By R. A. DICKSON

Cost Indexes for Process Industries.....124
By ROBERT W. STEVENS

Calculations for High Vacuum Systems.....127
By W. P. DRYER

Process Engineer's Guide to the Centrifugal Compressor—II.....132
By IGOR J. KARASSIK

Continuous Viscosity Measurement.....136
By WILLIAM A. DIAMENT

What to Look for at the Chemical Show.....138
EDITORIAL STAFF

The Plant Notebook.....144

Glassine Paper.....148
A "CHEM & MET" PICTURED FLOWSHEET

Sodium Chloride vs. Materials of Construction—Part II.....217
A SYMPOSIUM

Watching Washington.....76
Editorials.....89
Plant Notebook.....144
Equipment News.....155
Manufacturers' Publications.....171
Reader Service Coupons.....172
New Products.....175
News.....187
Convention Calendar.....188
Readers' Views.....202
Foreign News.....205
Corrosion Forum.....217
Log of Experience.....223
Personals.....233
Industrial Notes.....238
Convention Papers.....242
Foreign Abstracts.....252
Book Reviews.....257
Government Publications.....272
Economics.....281
Production Trends.....282
Production Data.....284
Prices.....290
New Construction.....294

CHANGE OF ADDRESS

Director of Circulation
Chemical Engineering,
330 West 42nd Street, New York 18, N. Y.:

Please change the address of my subscription.

Name .....

Old Address .....

New Address .....

New Company Connection .....

New Title or Position .....

the answer to many product problems

Polyethylene Glycols

PHYSICAL PROPERTIES

	LIQUID POLYETHYLENE GLYCOLS			
	200	300	400	600
Average Molecular Weight	190 to 210	285 to 315	380 to 420	570 to 630
Flash Point, °F.	350	385	435	475
Saybolt Viscosity at 210°F., sec.	38 to 41	42 to 46	45 to 55	60 to 70
Comparative Hygroscopicity (62% R.H. at 75° F., Glycerol = 100)	90	70	60	50

The polyethylene glycols may hold the answer to your product problems — as they have in so many other industrial applications.

The polyethylene glycols are a series of liquid polymers that are completely soluble in water and in many organic solvents. Water-white, these commercial compounds are less volatile than glycerol and hence more permanent. They are heat-stable, inert to many chemical agents, and do not hydrolyze or deteriorate. Their special characteristics can be advantageously applied in a variety of end uses.

Some present uses of polyethylene glycols

Plasticizers and dispersants— for casein and gelatin compositions, glues, zein, cork, and special printing inks.

Mutual solvents—for zein and other proteins, dyestuffs, and essential oils.

Lubricants—water-soluble lubricants in warp sizes and yarn conditioners.

Intermediates—for production of alkyd-type resins — emulsifying agents—detergents.

Humectants—particularly effective because of lower vapor pressure, wide solvent power, controllable hygroscopicity, and lower viscosity.

Complete data on these versatile materials is contained in the free booklet F-4772; when writing for your copy address Dept. B-11.

CARBIDE and CARBON CHEMICALS CORPORATION

Unit of Union Carbide and Carbon Corporation

30 East 42nd Street New York 17, N. Y.

Offices in Principal Cities

In Canada:

Carbide and Carbon Chemicals, Limited, Toronto

FIRST NAME IN QUALITY

SOLVAY

TRADE MARK REG. U. S. PAT. OFF.

PRODUCTS FOR THE GLASS INDUSTRY

Ammonium Bicarbonate

Potassium Carbonate

Caustic Potash

Soda Ash

SOLVAY SALES CORPORATION

Alkalies and Chemical Products Manufactured by The Solvay Process Company

40 Rector Street, New York 6, N. Y.

WATCHING WASHINGTON

R. P. McBride, EDITORIAL CONSULTANT
Donald O. Loomis, WASHINGTON CORRESPONDENT

Proposal made to ship machinery and goods abroad in exchange for strategic materials for our stockpiles . . . Tentative draft for International Trade Organization will come up for action at Havana meeting . . . Progress made on bi-lateral tariff negotiations between 18 nations . . . Bids asked for purchase of two German chemical works offered as reparation plants . . . Procedure for protection abroad for government-owned patents . . . . Most of surplus property of chemical significance has been sold to private interests

Strategics for Dollars

ALL of Europe and most of the Orient want dollars. They would much prefer gifts at the expense of American taxpayers. Some far-seeing parts of official Washington would like to know why some of the needed rehabilitation program can not be developed through exchange of strategics from abroad for urgent needs of machinery and construction materials going from this country.

Such exchanges could be made either to build the government strategics stockpile or to replenish depleted commercial stocks of raw materials. The division between government procurement and commercial buying would have to be adjusted for each commodity according to the urgency of commercial need. But the big hurdle is to get past the resistance of certain officials who, for reasons not wholly clear, are still opposing the program. Those who really know the reserve requirements appear strongly in favor of taking a billion or two dollars worth in the course of the four- or five-year rehabilitation program contemplated by the Marshall Plan.

The Strategics Program

CONGRESS formulated a stockpile program for strategics soon after V-J Day. Army and Navy Munitions Board estimates were announced indicating total dollar cost of the complete stockpile would be about $2,100 million. Also announced was the transfer to this stockpile of $300 million of surplus goods. Asked by the Board was an appropriation to complete stockpile building in three or four years.

Congress became economy minded. Actually made available and committed thus far is only $170 million; and deliveries on this are so slow that Washington guessers do not think more than $400 million is yet gathered.

Congress has said this official stockpile must be built so as to permit industrial purchases of currently needed imported goods. It is understood, therefore, that Congress would go along with a plan in which further purchases could be split appropriately. There are both governmental and commercial banking facilities that could finance deals where the government might need to have official participation. Hence most urgently needed now is some action by Congress to smoke out hidden reasons for opposition to the proposal to exchange materials.

"Interruptible" Contracts

NATURAL gas users are now confronted with the application of interruptible gas contracts to an extent never before experienced. Scarcity of transmission capacity will have serious results in some areas of large use this winter. The load on gas systems, both interstate and local, has grown beyond their ability to carry. Industry is the first to suffer.

In one instance Federal Power Commission has set up rules governing the cutoff that forecasts clearly the steps to be expected. Four stages of curtailment have been ordered on Panhandle Eastern Pipe Line Co. customers, as an emergency matter, pending the setting of permanent rules.

The four cuts affect first industrial customers. In case of shortage, a 50 percent reduction of deliveries on interruptible contracts takes place. If that is not enough, these customers are cut off wholly. In the third and fourth stages are cutbacks of 50 percent and then 100 percent on the pipeline and distributing users whose contracts permit that interruption. These drastic rules "provide for orderly control of loads during critical periods," according to FPC. And the forecast is particularly gloomy as the Commission comments on low temperatures as including all those "below 40 degrees Fahrenheit." Zero weather would, of course, be relatively a major catastrophe.

ITO Over Big Hump

AFTER six months of negotiations which proceeded concurrently with the reciprocal trade bargaining, the 18 nations at Geneva have come up with a draft charter for an International Trade Organization. The provisions go a long ways toward meeting objections to earlier drafts, but there still remains much work before the charter is ready for submission to the various governments.

U. S. delegates have reservations on some provisions as now drawn, but it is to be the job of the November meeting in Havana to iron out the numerous reservations held not only by the U. S., but also by other countries. For instance, U. S. questions the provision on export subsidies—they're to be banned two years after adherence to the ITO. U. S. wants all kinds of trade subsidies eliminated, if this provision on export subsidies is retained.

On import quotas, the U. S. put across its ideas. They are to be outlawed two years after the ITO becomes accepted by the member countries. An exception permits the use of import quotas when a country has an adverse balance of payments but the U. S. won its point on this in that it is to be the International Monetary Fund which will decide when the balance of pay-

Do you buy CORROSION PROTECTION BY THE GALLON? BY THE FOOT? OR BY THE YEAR?

THE photograph above shows two sections of a ceiling within 15′ of one another. The badly corroded area had been coated with one of the better industrial coatings. The one that looks as good as the day it was put on is coated with Tygon plastic Paint ... They both were exposed to the same conditions.

Frankly, you can buy "protective" coatings at a lower cost than Tygon; you can buy coatings that cover more feet per gallon. But you'll find it hard to buy real protection "by the year" at a cost anywhere near as low as you'll pay for Tygon protection.

For Tygon Paint doesn't chemically deteriorate with age; its tough, flexible, chemically-resistant film sets up a virtually impenetrable barrier against corrosion; stands up against the toughest conditions in your plant, month after month.

See Tygon Paint and other U. S. Stoneware products Booths 89-90-91, 21st Exposition of the Chemical Industries, Grand Central Palace, New York, December 1-6.

TYGON PAINT

Tygon Paint is pure Tygon plastic in a solvent vehicle; applied cold by spray gun or brush; air dries quickly to form a tough, flexible, impact-resistant plastic film; resists most acids, alkalies, oils, water, alcohols; available in white, black, gray, green, red, aluminum and clear.

U. S. STONEWARE

Akron 9, Ohio

ments is such as to permit imposition of quotas.

The ITO can't be in effect earlier than January 1949. It will have to be ratified by the legislatures of many countries, including our Congress. The charter probably will go through Congress as a joint resolution, not as a treaty. ITO is part of the UN and the American Congress approved our joining the parent organization.

War Reports Listed

RESEARCH reports of OSRD which were classified for military security reasons are now available to the extent of 2,500 documents, including many that before had high secrecy ratings. To facilitate use by industry, these have been indexed by Office of Technical Services in a list available to research and development groups. The index indicates author, subject, and scope (briefly) together with information regarding procurement in the form of PB documents reproduced under the system followed by OTS. Those wishing a copy of the bibliography and index can get a mimeographed copy by asking for PB 78000, available at 75 cents a copy through Office of Technical Services.

Exit Steelman Board

THE PRESIDENT'S Scientific Research Board blew out the first birthday cake candle on October 17 and then retired gracefully from the official stage. On that date it had completed printing for distribution of volume five of its series of reports on "Science and Public Policy."

This abrupt closing of Board activity was contemplated when it was founded, for President Truman set it up with a one-year limit on its life and work. It was thought that within that period it could prepare a set of guiding recommendations as to what should be done next in government research programs. Next expected are the naming of the recommended "Interdepartmental Committee for Scientific Research," the establishment of a budget coordinating unit, and the naming of a scientific liaison officer at the White House.

New Synthetic Rubber

A NEW ARAYLIC rubber which has been christened Lactoprene EV has been announced by the Bureau of Chemistry as a product developed at the Eastern Regional Research Laboratory of that Bureau. This is being made on small pilot plant scale in cooperation with the "Rubber Reserve" Akron laboratory. The copolymer mixture is 95 percent ethyl acrylate and 5 percent of 2-chloroethyl vinyl ether. Those responsible for the development believe that this copolymer formation is simpler than that of butadiene rubber.

Chemical Reparations

DESPITE the increase in productive capacity permitted German industry under the new level-of-industry plan, the long and involved reparations procedure is beginning to produce German plants and equipment that can be bought by U. S. industry. First plant, offered for sale in August, was a mill for rolling aluminum and tin foil. Bids were closed November 1.

Now comes the offer of two chemical facilities. One includes portions of the Dynamit A. G. Geestacht-Krummel plant consisting of 21 pieces of equipment including grinding mills, distilling vats, specially-lined storage tanks, and crushers for artificial resins. The other facility, the Paraxol plant at Lippoldsberg, Germany, includes one unit for production of formaldehyde and two for production of pentaerythritol, together with electrical generating capacity used with the units.

Just how many additional chemicals facilities may be offered for sale to American companies is not known. Total number of plants estimated to be put on the block for American purchase has ranged from 20 to 150.

In all cases, plants and equipment finally allocated to the U. S. for sale here have previously been checked with industry to learn whether there is any interest in the particular facilities involved.

Atomic Timetable

DON'T DELAY adding to hydro or fuel-generated power capacity because of the future availability of atomic power, Chairman David Lilienthal of the Atomic Energy Commission advises. The AEC timetable on commercial atomic power is sliding further into the future, and, as Lilienthal now sees it, it will be eight to ten years before electric power from a "useful practical demonstration plant" will be available. Heretofore, several of the AEC officials held the view that the beginnings of commercial power from the atom would be no more than five years distant.

Pilot plant operation of a thousand kilowatts or so will be working in about 18 months to two years, Lilienthal claimed—but atomic power supply of as much as 10 to 20 percent of the country's needs is "way far in the future." The new timetable is being stressed in answer to European claims that the U. S. is playing dog in the manger with a source of power that could solve the world's pressing shortage of fuel.

AEC accounts for this longer time span by citing the technical difficulties involved, the most serious of which appear to be chemical. In operating an atomic pile there is a gradual accumulation of fission fragments, lighter elements resulting from the splitting or uranium or plutonium. These must be chemically separated from the unconsumed fissionable material to keep the pile running. Methods of doing this have to be developed without losing any of the valuable uranium or plutonium.

Lilienthal points out that major problems of power generation are still at the level of university research rather than engineering investigation. Some people close to the atom project feel the longer time scale on atomic power production results, in part, at least, from a deliberate decision on the part of the commission. Putting power studies in the hands of academic groups frees nuclear and chemical engineering talent for the big jobs involved in rebuilding production plants for maximum output of material for bombs.

Pipeline Accounts

INTERSTATE Commerce Commission has promulgated a new system of uniform accounts for pipeline companies. This is important in considering future fuel supply by any big users of natural gas. Also it may have significance in relation to public utility account systems. The full official statement about the new system was published in the Federal Register of Friday, Oct. 3, 1947, beginning on page 6527.

Rubber Controversy

BASIC cause for much difficulty in planning a permanent synthetic rubber policy comes from a difference of opinion as to who shall pay the bills. There is much less controversy over the size of the needed reserve and little controversy over which plants ought to be kept going and which should be kept only for standby.

One argument runs like this: The government should not only operate plants making a quarter million tons per year of synthetic rubber, it should also maintain one-third of a million tons capacity ready to go on short notice. Since this is for military defense

Below are typical CMH Free-Flexing and Controlled-Flexing Expansion Joints . . . Engineered for simple, practical control of expansion, vibration and misalignment in your pipe lines.

CMH EXPANSION JOINTS . . .

the practical way

to ENGINEERED EXPANSION and VIBRATION CONTROL

Practical operating engineers need practical answers to expansion and vibration control problems in pipe lines — And CMH Expansion Joints provide those answers.

Compact, dependable, and adaptable for original installations, and for replacement of all types of obsolete expansion joints, CMH Free-Flexing and Controlled-Flexing Joints perfectly fit the needs of most plant piping layouts, new and old.

CMH Expansion Joints are copper or stainless steel, packless, bellows-type units, requiring no maintenance or other attention. Sizes range from 4" to 24" inside diameters, with flanged or welding ends to suit connected piping requirements. Conservatively rated for pressures up to 300 p.s.i., and temperatures to 900° F.

CMH-engineered curvature of corrugations distributes expansion loads throughout the pressure carrier to provide maximum fatigue resistance with its accompanying longer service life. Controlled-Flexing units have control rings designed to fit corrugation curvatures within close tolerances to effect positive protection against deformation under high pressures and temperatures.

CMH Bulletin EJ-47 gives technical data on all CMH Expansion Joints . . . For practical solutions of your pipe expansion, vibration and misalignment problems, write for your copy today. Personal engineering assistance will be given as required, without obligation.

"the science of FLEXONICS . . ."the controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion" . . . is exemplified in the basic products of Chicago Metal Hose Corporation.

"FLEXON" identifies CMH products, which have served industry for more than 45 years.

CMH

CHICAGO METAL HOSE CORPORATION

Expansion Joint Division
Maywood, Illinois
Plants at Maywood and Elgin, Illinois

purposes, the government should pay the bill. It is on this last phrase that serious argument develops.

Critics of that phrase say something like this: The rubber industry is protected against sudden interruption of raw material supply by having this active synthetic facility supported by the standby capacity. It is insurance against shutdown of the rubber products business to maintain this part of our wartime industry, and the rubber industry should pay for that insurance. The payment is, of course, suggested in the form of a sufficient price for the rubber made to compensate the government for both operating costs and standby costs.

Apparently much of the dispute expected between now and March ultimately will crystalize in an effort to settle this matter of allocating costs for readiness to run. Industry spokesmen thus far have not intimated any willingness to accept that part of the expense, even though they admit it could all be passed on to rubber-products users if all rubber companies were treated alike.

Tariff Revisions

Also coming to a conclusion about November 1 were the 108 simultaneous bi-lateral tariff negotiations between 18 nations going on in Geneva. Negotiations nearly collapsed several times, as when Congress raised the tariff rates on Australian wool, and when Britain contended she couldn't afford to act immediately in abandoning imperial preference by which intra-Commonwealth trade is favored.

Texts and terms of these agreements have been kept carefully under wraps; publicity was held up until all terms could be released simultaneously. Tentative schedule calls for the provisions to be effective Jan. 1, 1948, for those countries in which legislative action is not required. To make them effective the executive branch in the U. S., as well as in the other key countries, has the authority to promulgate the new agreements without calling upon the consent of Congress. The agreements are intended to run for three years.

$7,000,000 a Month

Sale of chemicals and allied products to the federal government still is "big business," it is revealed by a study of recent awards under the Public Contracts Act. While naturally reduced from wartime levels, the value of government contracts let for the manufacture or furnishing of chemicals and allied products during the two years since the end of the war, nevertheless has averaged more than $7,000,000 a month. Between Sept. 1, 1945, and Sept. 1, 1947, the value of such contracts throughout the nation has been $181,515,434.

The Public Contracts Act applies to the manufacture and furnishing of commodities for the government under contracts in excess of $10,000. Of the approximately $125 billion worth of purchases made under the Act since 1936, more than $2½ billion has been for chemicals and allied products, according to the Wage and Hour and Public Contracts Divisions, U. S. Department of Labor.

US Patents Abroad

Companies or industries that want the government to get patent protection abroad on government-owned patents should check immediately with Office of Technical Services, Department of Commerce. Drug producers were the first to take advantage of a Presidential directive to Commerce to determine which government-owned inventions should be patented abroad and then to act as the government's agent to work with industry to secure the patent protection.

Drug manufacturers were interested in having the government patent its anti-malarial compounds developed under government contracts during the war. If this isn't done, they felt, it would be possible for a national of many foreign countries to get patent rights to these compounds in his own country, and freeze out the U. S. product or collect a royalty on all sales within that country. This is an example of the interest which industry may have in something that at first glance appears to be strictly the government's own business.

Insecticide Regulations

Regulations for enforcement of the Federal Insecticide Act were promulgated formally early in October. A few modifications in the preliminary rules were made to meet criticisms presented by spokesmen of industry. Some divisions of industry seem well satisfied with the result. Others remain unhappy.

One fear frankly expressed is that the regulations may be misused in future court cases. Loose phraseology changed at spots would, it appears, permit the Secretary of Agriculture to take rather drastic control steps. Those procedures are probably not now contemplated. In fact, some are definitely disclaimed by junior officials. But so long as they remain possible within the regulations, there will be a feeling that some day some overzealous subordinate might use the form of the regulations as an excuse for unreasonable regulatory procedure.

Despite this fear, all insecticide manufacturers seem to be working along very cordially with the technical staff of Insecticide Division.

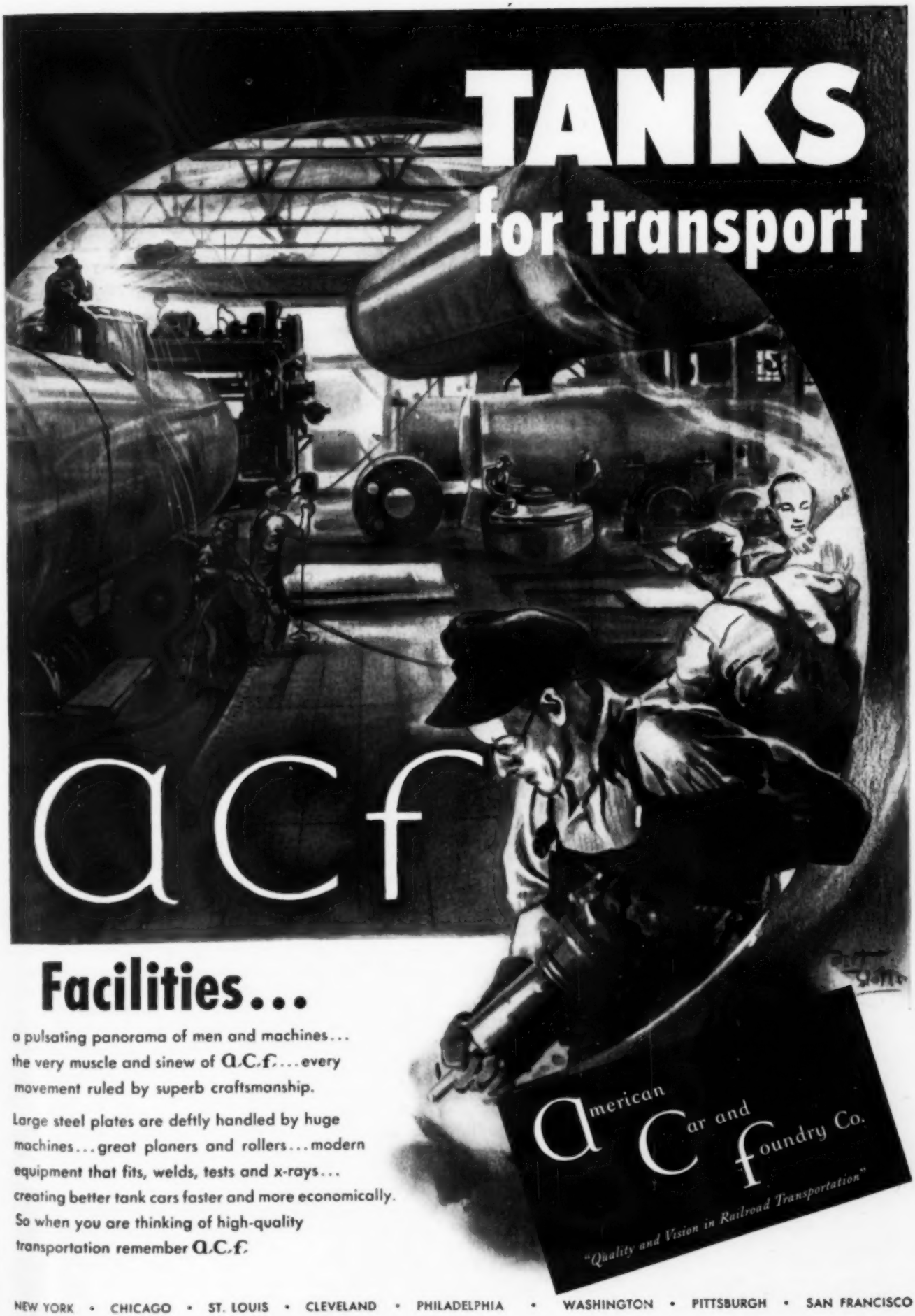
Federal Science Program

With the completion of the five-volume study on "Science and Public Policy" by the President's Scientific Research Board, look for the promulgation of these three recommendations made in volume one, "A Program for the Nation"; Formal organization of a permanent Interdepartmental Committee to help maintain a balance in the government's every-spreading research activities; establishment in the Bureau of the Budget of a unit to check and clear the budgetary control of government research; and appointment of a Presidential assistant to be White House liaison with the whole federal research effort.

"The Federal Research Program" (Vol. 2) is most useful for its 250 pages which describe in considerable detail the actual research programs of 16 federal agencies. While the Army and Navy account for 80 percent of the total research expenditure, based on fiscal 1947, the description of their activity covers only 30 of the 250 pages outlining government research by all agencies. Hence the volume is especially useful for those interested in non-military research.

"Administration for Research" (Vol. 3) re-affirms the three recommendations noted above, with the addition of a fourth: "A National Science Foundation on sound lines should be established"—a direct reference to the President's veto of the Science Foundation Bill that passed Congress last session.

Among a score of other recommendations on direction of government research programs are these: Each department should concentrate its research in one, or a few, large research centers; efforts to secure workable standard means of identifying, classifying, and cataloging of research reports should be speedily completed; every federal laboratory should have a program and project planning board of scientists and administrators; legislative authority should be granted to all agencies to pay up to $15,000 per year to their top scientists; in military research, at the laboratory level, scientists should be placed in charge of research programs, with administrative functions under the commanding officer; more funds should be provided



Facilities...

a pulsating panorama of men and machines... the very muscle and sinew of A.C.F.... every movement ruled by superb craftsmanship.

Large steel plates are deftly handled by huge machines... great planers and rollers... modern equipment that fits, welds, tests and x-rays... creating better tank cars faster and more economically. So when you are thinking of high-quality transportation remember A.C.F.

American Car and Foundry Co.

"Quality and Vision in Railroad Transportation"

NEW YORK • CHICAGO • ST. LOUIS • CLEVELAND • PHILADELPHIA • WASHINGTON • PITTSBURGH • SAN FRANCISCO

for wider publication and dissemination of research results.

"Manpower for Research" (Vol. 4) also emphasizes the short-term shortages of scientists and expresses some doubt as to the number of high-quality scientists that will be produced in the long run by the mass-production that is a feature of our postwar colleges and universities.

Its concrete recommendations include: Increasing financial support for colleges and universities to enable them to expand their plant, increase their staff, and pay better salaries; developing a broad program for support of basic research in the universities and colleges; preparing to finance students through scholarships and fellowships as the GI benefits begin to expire.

Engineers Wanted!

SEVERAL chemical engineers have been sought to assist occupation, reparation, and rehabilitation agencies of the government. In several cases well paid chemical engineering jobs have been established in order to attract the best available talent for places like Greece, Korea and Germany. Many decisions necessarily made on the ground in those countries involve questions which no one but a very competent engineer can answer.

The State Department, among others, has been complimented by its willingness to offer something approaching an adequate salary for these government tasks. In one such case, compensation of $12,000 per year was supplemented by a living allowance worth at least $2,000 more annually. Even so, the government has been having difficulty getting capable men to go to these troubled areas.

Most All Sold

SURPLUS property of interest to chemical and process-industry groups is now largely disposed of by War Assets Administration. Aviation gasoline facilities which cost the government $260 million are roughly three-fourths in the hands of private industry. Much of the rest is not at attractive locations or does not represent interesting equipment. Much of the remaining surplus petroleum processing facilities was designed primarily to produce toluene.

The staff of the chemical facilities division disposal group is taking quite seriously orders from the top that sales or long-term leases must be largely completed before next July. They confess there will remain some substantially unsaleable facilities at that stage. Apparently the question will be how those can be cannibalized to achieve maximum return and to eliminate government maintenance of plants that have neither military nor sales value comparable with the cost of caring for them.

British Patent Promotion

THE BRITISH aren't reacting favorably to a proposal advanced by the President last June that the U. S. and other governments exchange government-owned patents which each has registered in the other's patent office.

The reason is that the British government itself has a considerable property interest in patents—jet engines are an example—and the British want to use these patents as a method of adding to their slim supply of dollars. Our government, on the other hand, has very few patents, relatively speaking, and consequently would be on the receiving end in this international arrangement.

Part of the picture, too, is the British government's questioning royalty payments to government employees on patented inventions developed by U. S. government employees using government facilities and on government time. They pay, for instance, royalties on a parachute developed by an Army Colonel. The U. S. liberality in giving commercial patent rights to its employees isn't followed in Britain or in other countries.

Why Not in Europe?

SHORTAGE of nitrates for fertilizer in Europe still plagues Washington. One proposal of an industry spokesman is novel, and not yet accepted. He suggests that Europe use one percent of its present coal supply to run nitrate plants and thus be wholly independent of American nitrogen-compound supply. Saving of ship space would permit coal movement to areas of need far greater than equivalent to the coal diverted to fertilizer making.

Official Washington questions whether coal shortage is the only factor needing correction. But some movement in this direction is admitted to be feasible if the policy decision should turn in this direction.

Waterproofing Test

TO TEST the water-proofness of leather, the National Bureau of Standards has developed a new procedure "which more nearly simulates actual use." Applied to both sole leather and upper leather of shoes the results indicate, the Bureau says, more closely than ever before possible the probable usefulness of leather and leather treatment methods. Leather which breaks down under the non-pressure test in 200 flexes would be wet through on a shoe in a quarter-mile walk. Heavily greased leather might last the equivalent of several miles, or 10,000 flexes. But many such treatments are proven in practice to be impractical because such treated leather is not suitable for shoe making. Thus, the Bureau emphasizes, this new test is only one of several criteria needed.

News Glimpses

Freight rates were upped by Interstate Commerce Commission 10 percent for all except coal, coke and iron ore, as an emergency offset for increased railroad employees wages. When ICC finishes its extended hearings and adopts a permanent rate increase, it will supersede this temporary allowance.

Tax exemption on new plant installations in Puerto Rico is granted under regulations recently promulgated by the insular government. Applications from new enterprise or for new establishments go to the special secretary to the Executive Council, a member of the staff of the governor of Puerto Rico.

Termite control by mixing poisons with soil is being investigated in a special study of the Bureau of Entomology. Chemicals being tested by intermingling in the soil around posts are: Sodium arsenite, lead arsenate, sodium fluosilicate, cryolite, phenothiazine, pentachlorophenol, and orthodichlorbenzene.

Atomic energy advisers now include a newly named "industrial advisory group" headed by James W. Parker, president of Detroit Edison Co. and supported by six other industrialists, two of them chemical engineers. This committee is supposed to assist Atomic Energy Commission in formulating programs that can have full commercial support.

Better use of scientists is planned by the War Department. This is a definite result of replies to a questionnaire submitted asking what chemical people thought of their own experience during World War II. So many felt that they had not been adequately used that military executives think that something should be done about correcting this situation.

CHEMICAL ENGINEERING

with CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902 NOVEMBER 1947 SIDNEY D. KIRKPATRICK, Editor

STOCKPILING IN EARNEST

WASHINGTON is in the process of radically revising its idea of what even a few months ago was regarded on paper as an adequate stockpile of critical and strategic materials. The new Munitions Board, under the chairmanship of Eastman-president Thomas J. Hargrave, is taking a much more realistic attitude toward its responsibilities for the national security. The tenser international situation has energized the stockpilers to begin immediately in the procurement of the sixty-odd commodities most needed by the military. This decision was made despite high prices that may go even higher when the Board gets farther into competition with private industry.

Meanwhile its money goal for an adequate stockpile was revised upward last spring from $1.8 billion to $2.2 and now sights are raised again to $2.5 billion. It may be possible to balance a small part of this off against grants under the Marshall plan, but unfortunately too many of the needed minerals and metals are still in the ground with no manpower or machinery available for their production.

Such is the sorry commentary on our times—that we must invest so heavily in the only kind of war insurance that certain parts of the world can understand and recognize.

CHEMICAL ENGINEERING FRONTIERS

OUR profession and industry recognize no geographical boundaries. The war carried our technology into every corner of the country. In two years of peace, American chemical engineering know-how, plants and processes have become one of our most widely sought exports. Nevertheless, there are frontiers here at home where brave men and their companies are pioneering their way into vast unexplored and unexploited fields. One of these is recognized by this year's Award for Chemical Engineering Achievement, which is featured in this issue.

A new technology—Biochemical Engineering—is already making distinguished contributions to the health and security of mankind. The knowledge and disciplines of many sciences—chemical, physical, biological and medical—combine with the techniques and skills of chemical engineering to solve the practical problems of large-scale production. It makes possible many advances in medicine and pharmacology that might have been delayed if not defeated by outmoded methods and equipment.

But medicine is not alone in the benefit derived from biochemical engineering. Fermentation, food preservation and processing, animal and plant studies, soil fertilization, insect and pest controls—are other fields that stand to gain as biological researches are applied with engineering precision and efficiency.

Today we hail those who are pushing along new frontiers of chemical engineering. Their creative accomplishments are our challenge to prove that our profession is but at the beginning of its resourceful services to mankind.

BETWEEN SHOWS

THIS note is written from California where the first Pacific Chemical Exposition has just added a new chapter in the historical advance of chemical engineering. It brought together for the first time the men and machinery that are building a great industrial empire in the West—an empire that will contribute much to the balance and integration of our American economy; one that can, and hopes to, aid in the overdue revitalization of the Orient. It dramatized progress of the Pacific area and its dependent periphery, by pointing to the needs as well as the assets of this rich regional economy. One benefit that seems most important to us is the knowledge and better understanding of western problems to be gained by all who visited the exhibits and participated in the many well attended industrial conferences. For our part, we are glad we made the trek across the country, for it renewed our confidence and faith in the expanding future of our profession. We are looking to the progress that will be reported at the next Pacific Chemical Exposition two years hence.

Now with many more thousands of you, we turn our eyes toward the Eastern Seaboard—to the Grand Central Palace in New York where the 21st Exposition of the Chemical Industries will get under way December 1. Here is the granddaddy of them all—the original "Chem Show" that for generations has pointed the way for the future growth and development of our industries. The theme this year is postwar progress—and there has been plenty of it when we really get down to taking stock of accomplishments in the process industries since V-J Day. Not all the dream stuff of the comics has come into fruition, but there have been literally hundreds of new products and processes that are certain to have their effect on our daily lives and duties.

So it is that the "Chem Show" serves you best by drawing back the curtains to give you a brief look at the

future of your job. Here is the place to take your problems—to match your ideas and needs with those of others who have faced and solved similar difficulties. Here is the place to come with open mind to see and hear, to study and report, to plan and procure the tools and materials that will make your future more efficient and more productive.

If we can help, you will find us, as usual, in the same old Booth 42 we've occupied these past twenty-odd years.

FEWER FLUID FUELS

RECORD operations in industry are imposing all-time record demands on fuel supplies. Process industries are no exception to the rule. In fact, chemical engineers have more reason to worry than almost anyone else.

Natural gas and petroleum are ideal fuels for many industrial operations. Delivery of these materials to centers of industry is going on at record rates. But the demands there have grown faster than the supply. Natural gas is even more likely to be scarce than is petroleum; and everyone knows about the prospective scarcity of petroleum products in several well populated areas.

Federal Power Commission has gone a long way toward correction of some of the difficulties for the early future. It has authorized some huge new gas projects in the gathering areas of the Southwest and in pipeline improvements. In one case alone changes from 380,000,000 to 600,000,000 cubic feet per day will be accomplished by spending about $53,000,000 on betterments of gathering, compression, and loop-line connections.

The smart chemical engineer is watching these developments closely. He must be prepared with alternate fuels if the higher priority of household supply takes all of the transmission capacity to his area. None of us may become complacent in this period of rapid change.

ORIENTATION VS. GRAVITATION

STUDENT chapters and junior engineer groups are finding that some of their most valuable talks are made by young men who have only recently entered the ranks of the industry and profession. One such speaker who greatly impressed us recently was Dr. Paul C. Baldwin of the Scott Paper Co. He had returned to the Institute of Paper Chemistry, from which he had been graduated in 1940, and his assignment was to describe the transition from academic life to his job in industry.

Here, he said, are the thoughts that are going through the mind of the man about to enter industry: (1) *At last*, I'm through with school. (2) Industry, here I come! (3) Here's my chance to find out if they knew what they were talking about in the Institute. (4) Here's my chance to correct the mistakes of industry. (5) Was the time I spent in school worth while? (6) How much do I get, what's the vacation plan, where's my private secretary and pushbutton? I hope they like me. I hope I like them!"

Translating these thoughts into more concrete reactions, Dr. Baldwin made these pertinent observations about the new man in industry: (a) He will try very hard to make a series of good first impressions. (b) He will feel lost and a bit of a misfit at first—will often ask himself if he has made the right move. (c) He will be in need of encouragement and advice. (d) He will face all the problems of making a new life in a new environment. (e) He will want to assume responsibility quickly—sometimes before he is ready for it. (f) He will be very anxious to know all about the company employing him.

All this suggests that the new employee in industry is often up against some psychological problem that may contribute to low productivity and personal dissatisfaction. To shorten this period of uncertainty, many companies have developed thoroughly planned programs of orientation and introductory training. Has yours?

REFEREES NEEDED

THE WAR Department has announced that it intends to keep about 60 government-owned industrial plants in readiness for specialized production in event of another war. The Army is studying methods for maintaining such plants in a ready-to-serve status. One of the serious problems is to make sure that this two and a third billion dollars worth of industrial investment does not become obsolete or seriously obsolescent.

Secretary Royall has officially stated that some of these plants should be leased out for industrial operation in order to lower the cost of keeping them and to insure better condition and a minimum of obsolescence. He has recognized that proper engineering reappraisal must be made of all from time to time in order to bring the plants up to date as technologic advances are made.

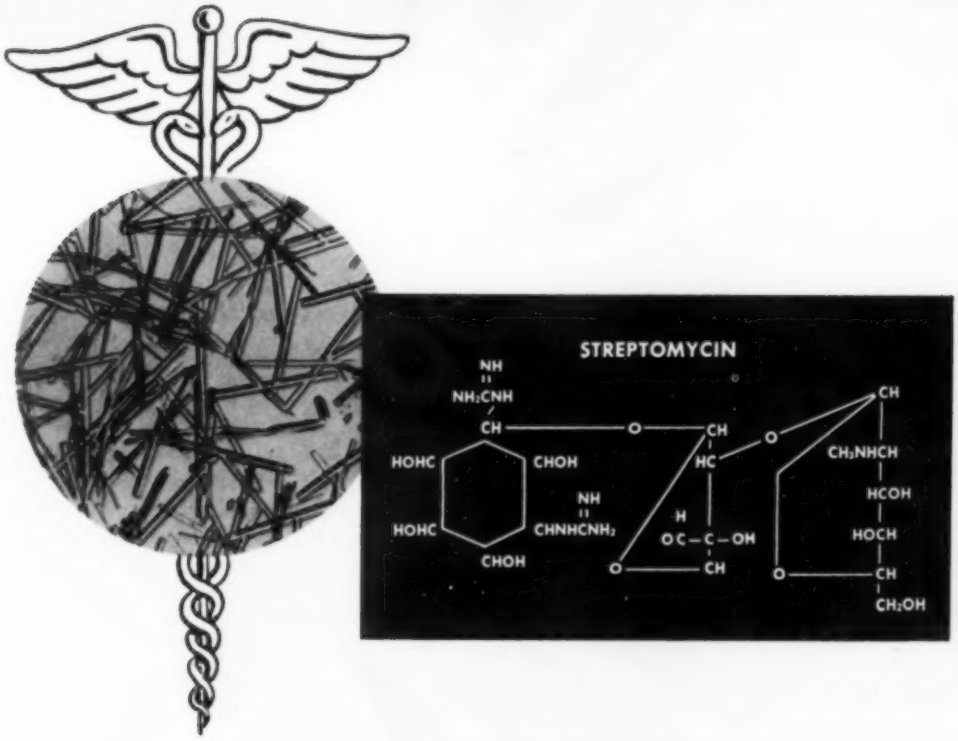
Engineering referees are going to be required to judge how costs for modification should be divided between government and industrial lessee. Where the plants are idle, engineering review and prompt plans for modification are going to be needed from time to time also. Professional engineers have a responsibility to the government and to the public to help on these projects. We believe that they will respond to the call for duty as soon as the Department works out its program to the point that it can use service in specific cases.

NEW RAW MATERIALS

WHEN fats and oils are again plentiful, as we may expect them to be soon, we may find that the chemical industry is beginning to draw upon modified fatty acids as a new source of useful raw materials. Outstanding among the advantages of this source is the fact that annual replacement is possible, offering a virtually inexhaustible supply.

Research at many locations can be counted upon to make these materials useful in a wide variety of products. The recently released annual report of the Bureau of Agricultural and Industrial Chemistry mentions just a few.

Two methods have been developed at the Eastern Regional Research Laboratory for converting oleic acid into chemical derivatives potentially useful in industry. In both cases materials are achieved which can be used as intermediates in the preparation of lubricants, polymers, plasticizers, and high-melting synthetic waxes. Both methods are said to be suitable for commercial application and interest in them has been shown already by a number of chemical manufacturers. It is gratifying to the taxpayers to learn that federal research dollars are producing useful results.



For Distinguished Service

TO HUMANITY

ENGINEERING, by definition, is the art of organizing and controlling the forces and materials of nature for the benefit of the human race. Thus the contributions of chemical engineering to the health, welfare and security of mankind are its greatest achievements. As we slowly emerge from a war of unprecedented destruction, we find our profession, with a wholesome recognition of its public responsibilities, working intently on human problems as basic as those of life itself. Postwar developments in the engineering applications of the biological sciences may yet make man the master of his fate!

Most appropriately, therefore, the 1947 Award for Chemical Engineering Achievement recognizes the valiant group effort of scientists and engineers in an organization long distinguished for its chemical contributions to modern medicine. The Committee of Award, comprised of more than fifty leading educators under the chairmanship of Professor-Emeritus Alfred H. White, has voted that

the outstanding postwar achievements of the nation in chemical engineering are those of Merck & Co., Inc., of Rahway, N. J. This decision was based not alone on Merck's successful pioneering in the large-scale production of the "wonder drug," streptomycin, and other vital medicinals, but also on the company's constructive policies and practices in encouraging its chemical engineers to participate broadly in all affairs of its growing industry. And, in an even broader sense, this is a tribute to a new technology—Biochemical Engineering—for distinguished service to humanity.

In few other fields are men in industry confronted with problems of such complexity, requiring for their solution such a wide combination of skills and disciplines. Scientific research—chemical, physical, pharmacological and medical—must be intelligently and profitably translated into better, less expensive and more useful products. This is the challenge and opportunity met by Merck's chemical engineers in helping to bridge the gap between the precise researches and controls of the laboratory and the efficient, large-scale processes of modern chemical manufacturing.

To recognize just such achievements, this unique award was established in 1933. Unlike most medals and similar citations, this award goes to a company, rather than to an individual, because its prime purpose is to recognize group effort as symbolized by the industrial achievements that result from the co-ordinated endeavors of an entire organization—of its executive, research, engineering, production and sales staffs.

The first of these awards was made in 1933 to the Carbide & Carbon Chemicals Corp. for its signal achievement in developing an aliphatic synthetics industry based on the hydrocarbons of petroleum and natural gas. The second award recognized the work of the Organic Chemicals Department of E. I. du Pont de Nemours & Co., Inc., in the production

Committee of Award for Chemical Engineering Achievement

CHESTER P. BAKER, Northeastern University, Boston, Mass.
WALTER H. BEISLER, University of Florida, Gainesville, Fla.
HENRY K. BENSON, University of Washington, Seattle, Wash.
ROBERT M. BOARTS, Jr., University of Tennessee, Knoxville, Tenn.
CHARLES F. BONILLA, Johns Hopkins University, Baltimore, Md.
GEORGE GRANGER BROWN, University of Michigan, Ann Arbor, Mich.
A. P. COLBURN, University of Delaware, Newark, Del.
LEWIS A. CONLEY, Rensselaer Polytechnic Institute, Troy, N. Y.
A. H. COOPER, Bucknell University, Lewisburg, Pa.
JAMES COULL, University of Pittsburgh, Pittsburgh, Pa.
D. S. CRYDER, Pennsylvania State College, State College, Pa.
BARNETT F. DODGE, Yale University, New Haven, Conn.
CHARLES G. DUNCOMBE, University of Detroit, Detroit, Mich.
O. E. DWYER, University of Rochester, Rochester, N. Y.
JOSEPH C. ELGIN, Princeton University, Princeton, N. J.
C. S. GROVE, Jr., The State University of Iowa, Iowa City, Iowa
ARTHUR J. HARTSOOK, The Rice Institute, Houston, Tex.
CHARLES HECKER, Clarkson College of Technology, Potsdam, N. Y.
ARTHUR W. HIXSON, Columbia University, New York, N. Y.
PAUL M. HORTON, Louisiana State University, Baton Rouge, La.
OLAF A. HOUGEN, University of Wisconsin, Madison, Wis.
ROBERT M. HUBBARD, University of Virginia, Charlottesville, Va.
WILBERT J. HUFF, University of Maryland, College Park, Md.
R. L. HUNTINGTON, University of Oklahoma, Norman, Okla.
H. F. JOHNSTONE, University of Illinois, Urbana, Ill.
KENNETH A. KOBE, University of Texas, Austin, Tex.
WILLIAM N. LACEY, California Institute of Technology, Pasadena, Calif.
JAMES D. LINDSAY, A & M College of Texas, College Station, Tex.
JAMES R. LORAH, University of Missouri, Columbia, Mo.
CHARLES D. LUKE, Syracuse University, Syracuse, N. Y.
CHARLES A. MANN, University of Minnesota, Minneapolis, Minn.
JESSE W. MASON, Georgia School of Technology, Atlanta, Ga.
M. C. MOLSTAD, University of Pennsylvania, Philadelphia, Pa.
CARL C. MONRAD, Carnegie Institute of Technology, Pittsburgh, Pa.
HARVEY A. NEVILLE, Lehigh University, Bethlehem, Pa.
DONALD F. OTHMER, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.
CARL F. PRUTTON, Case School of Applied Science, Cleveland, Ohio
ARTHUR H. RADASCH, Cooper Union, New York, N. Y.
FRED H. RHODES, Cornell University, Ithaca, N. Y.
J. HENRY RUSHTON, Illinois Institute of Technology, Chicago, Ill.
R. NORRIS SHREVE, Purdue University, Lafayette, Ind.
LEON D. STRATTON, Drexel Institute, Philadelphia, Pa.
ORLAND R. SWEENEY, Iowa State College, Ames, Iowa
REUBEN S. TOUR, University of Cincinnati, Cincinnati, Ohio
ROBERT E. TREYBAL, New York University, New York, N. Y.
FRANK C. VILBRANDT, Virginia Polytechnic Institute, Blacksburg, Va.
J. S. WALTON, Oregon State College, Corvallis, Ore.
ALFRED H. WHITE, *Chairman*, Professor-Emeritus of Chemical Engineering, University of Michigan, Ann Arbor, Mich.
WALTER G. WHITMAN, Massachusetts Institute of Technology, Cambridge, Mass.
ERNEST D. WILSON, Worcester Polytechnic Institute, Worcester, Mass.
GORDON C. WILLIAMS, University of Louisville, Louisville, Ky.
JAMES R. WITHROW, The Ohio State University, Columbus, Ohio

of synthetic rubber from acetylene and the commercial synthesis of camphor from American turpentine. Monsanto Chemical Co.'s large-scale development of the electric-furnace production of elemental phosphorus won the third award in 1937, while two years later the fourth went to the Standard Oil Develpment Co. for distinguished work in developing processes for new aviation fuels and synthetic chemical products from petroleum. Then in 1941—five days before Pearl Harbor—the Dow Chemical Co. was accorded this recognition for recovering from the sea the magnesium metal so urgently needed in larger supply for aircraft and munitions.

During the four fateful years that followed, all industrial resources were pooled patriotically in the greatest group effort in history. It was most appropriate, therefore, that in 1943 the Committee of Award should vote unanimously to present the sixth award to the entire American synthetic rubber industry—particularly to those chemical, rubber and petroleum companies that carried the major responsibility for this great wartime achievement.

Confronted with an equally difficult decision in 1945, the Committee again voted unanimously to accord this recognition to the Atomic Bomb Project, thus honoring more than a hundred companies, universities and research organizations whose chemical engineers contributed most significantly to the greatest scientific and industrial undertaking of all time.

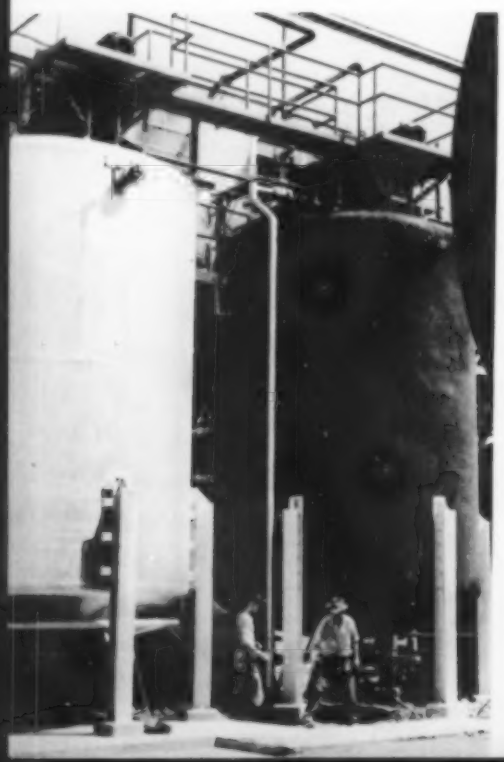
Now, with the war more than two years behind us, this award returns to its original purpose of recognizing group effort within a single company rather than in an entire industry or group of industries. That this recognition is now accorded to Merck & Co., Inc., for its postwar contributions to humanity is in keeping with the highest ideals and traditions of the chemical engineering profession.

S. D. KIRKPATRICK
Secretary, Committee of Award

NEWEST building on the Rahway campus, appropriately christened Merck's headquarters for "Sterile Techniques"

A CASE STUDY IN

SIDNEY D. KIRKPATRICK

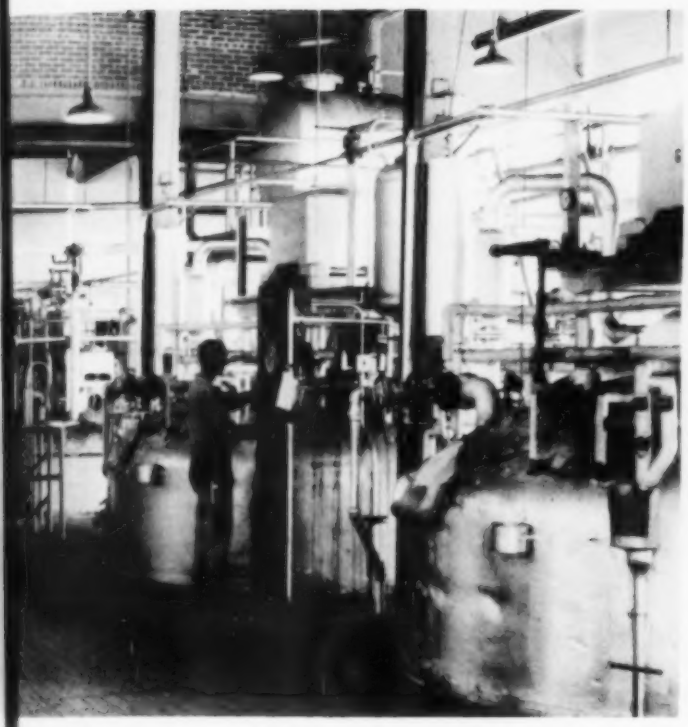


BROTH storage tanks full of food for hungry fungi; each fermenter requires 15,000 gal.

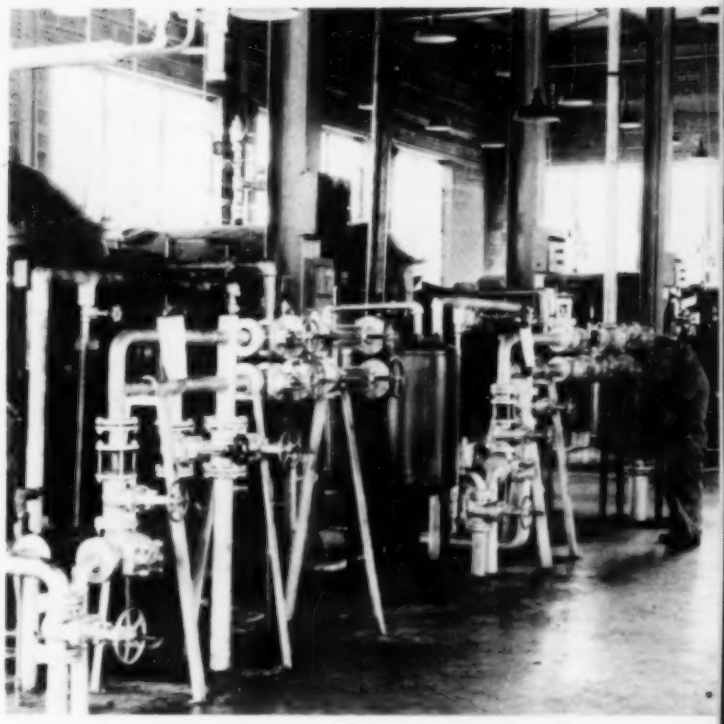
MERCK'S BRILLIANT STREPTOMYCIN ACHIEVEMENT TYPIFIES THE POTENTIALITIES OF A NEW TECHNOLOGY

VANNEVAR BUSH ably presented "The Case for the Biological Engineer" in a lively symposium that featured the one hundred and seventy-fifth anniversary celebration of Rutgers University in 1941. In searching for a parallel to prove his point that a biological engineer was neither a biologist with a smattering of economics, nor a business man who had studied Biology I, he chose this interesting analogy:

"The most rapidly developing field of engineering at the present time is probably that of the chemical engineer. When the chemical industry first began its phenomenal growth in this country there were primarily two types of professional men involved – chemists who manipulated test tubes and retorts in laboratories, and mechanical engineers who built and operated pumps and tanks in the plants. What more natural than to create chemical engineers by giving them a scanty chemical training, and an equally scanty training in mechanical engineering? The result was not a happy one, and it was not improved until a group of men, notably the late William H. Walker, created a new philosophy for chemical engineering based on the concept of the unit process. The chemical engineer of today



GROWN first in test tubes, then through increasingly larger tanks, the micro-organisms yield their final stage of fermentation in these vessels



STREPTOMYCIN solution from fermenters, having reached concentration of about 0.005 percent, is recovered in continuous pressure filters

BIOCHEMICAL ENGINEERING

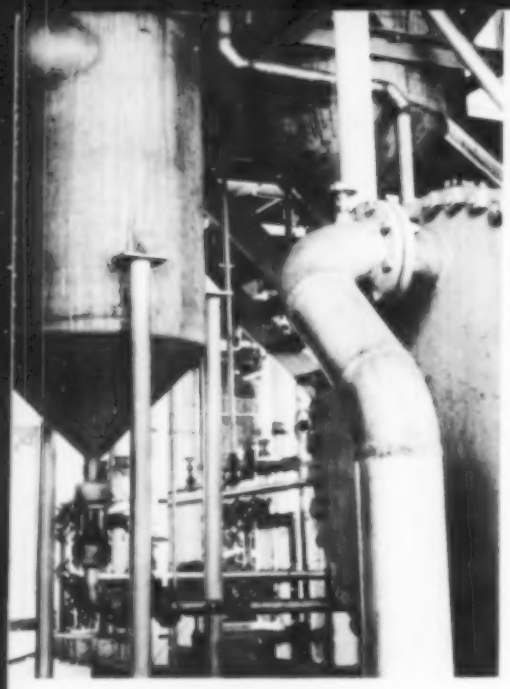
is a far different individual from a mere hybrid chemist-mechanical engineer; he has a whole approach and a set of thought processes which are uniquely his. He has avoided being superficial in two subjects by creating a third in which he can be decidedly thorough."

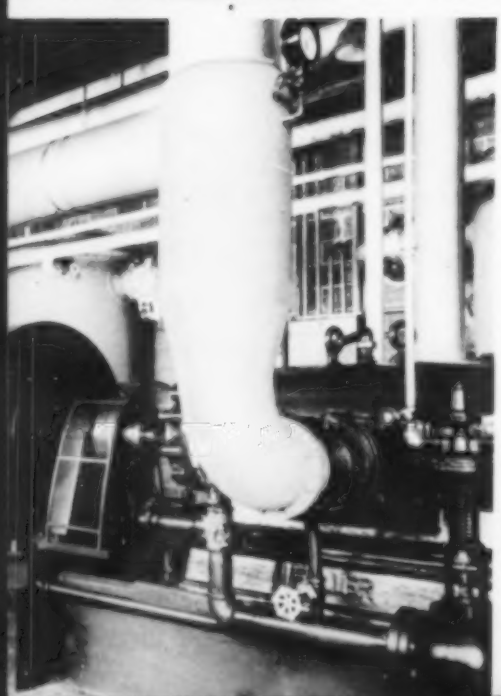
A similar philosophy and evolution were foreseen by Dr. Bush in the development of a still newer profession which he chose to call "Biological Engineering." With his reasoning we shall have no serious quarrel, although our immediate preference in the matter of nomenclature is for "Biochemical Engineering."* In fact, as Dr. Bush himself pointed out, much of the opportunity as well as the need for applied biology has resulted from the impact on biology of the sister sciences of biochemistry and biophysics. And let us not forget that chemical engineering is primarily physics and chemistry, expressed in the language of mathematics with due respect for the consumer's dollar.

What has this to do with the 1947 Award for Chemical Engineering Achievement to Merck & Co., Inc., for its postwar development of streptomycin and other vital medicinals? The answer, which the Committee of Award proposes to prove to the broader jury of the chemical engineering profession, is that these accomplishments would have been impossible within the time available and with the requisite efficiency and resulting savings of human life were it not for a unique technology which, at the professional level, combines the knowledge and skills of microbiologists, clinicians, chemists, physicists and engineers!

Much of the story of streptomycin is already familiar to the readers of *Chemical Engineering*. The "first" plant article by Richard W. Porter in October, 1946 (pp. 94-8 and 142-5) described the many unusual techniques developed and applied by Merck's chemical (Shall we say bioch .nical?) engineers in putting this product into commercial production. And streptomycin's story is now told again in this issue in the series of unusual pictures on four following pages. For present purposes, therefore, let us review chronologically some of the steps involved in this development, first to see where and how they originated, what manner of men were responsible, how their special knowledge and skills were coordinated into such a productive group effort. Perhaps in so doing we can prove our case for biochemical engineering.

*It is also that of President E. B. Fred, eminent agricultural bacteriologist at the University of Wisconsin, whose institution has been the first to set up a course in Biochemical Engineering as part of its chemical engineering curricula. (See *Chem. Eng.* July 1947, pp. 202-3.)





Streptomycin followed hard on the heels of penicillin, which was the discovery of the British biologists, Dr. Alexander Fleming and Dr. Howard W. Florey, both of whom have since been raised to knighthood by a grateful Britain. Penicillin has proved a great boon to humanity because of its amazing effectiveness against those Gram-positive organisms that have long plagued the human race. But, unfortunately, penicillin has proved ineffective against equally dangerous bacteria that react negatively to this staining procedure devised many years ago by the Danish physician, Dr. Hans Christian Gram. So under the impetus of the penicillin development, literally tens of thousands of molds and similar microbial organisms were tested by microbiologists in hundreds of laboratories throughout the world. The first promising lead was reported by Dr. Selman A. Waksman, Russian-born scientist who since 1939 had been working at the Rutgers University Experiment Station on the anti-bacterial activity of materials obtained from the metabolism of various soil organisms – principally molds and fungi. His first experiments produced a mold metabolite, called streptothricin, obtained from *Actinomyces lavendulae*, which was found to be very effective when used against Gram-negative bacteria. When clinical studies by pharmacologists in the Merck Institute for Therapeutic Research proved that the new material was too toxic for medicinal use, Dr. Waksman continued his research among other members of the *Actinomyces* family. In January 1944 he and his colleagues at Rutgers found that surface cultures of the micro-organism, *Streptomyces griseus*, produced an antibiotic that was even more effective against Gram-negative bacteria, and since even the very first impure preparations were of such low toxicity, it promised a very favorable therapeutic index.

Merck's chemists and biologists, who had spearheaded much of the feverish research and development of penicillin, welcomed the opportunity to begin their laboratory work on the new antibiotic in April 1944. Small quantities of streptomycin were obtained from surface cultures and tested not only by Merck & Co., Inc., but also by collaborators in many laboratories and hospitals throughout the country. Early clinical results were very encouraging, including those from Dr. W. Feldman and Dr. H. C. Hinshaw of the Mayo Clinic, Rochester, Minn., who stated that in their preliminary tests streptomycin seemed to be effective against certain types of tuberculosis in animals. Its great potential importance thus recognized, Merck in the fall of 1944 marshalled all the available manpower and resources of its Research and Development Division to produce larger samples for further study and testing.

top: **SEPARATORS** *prevent entrainment losses of streptomycin liquor from the evaporators*

center: **DISTILLATION** *towers recover the solvents used in extraction and purification*

bottom: **ROTARY COMPRESSORS** *supply the large volume of air required in fermentation*

This first material was obtained from surface cultures in the laboratory, but early in January 1945, through the combined work of the microbiologists and engineers, streptomycin was being produced more effectively from submerged cultures in a pilot plant employing the deep fermentation tanks previously used for the experimental production of another material. Considerable quantities were now available, not only for clinical testing, but also for intensive chemical research on methods of purification and study of behavior under conditions of large-scale production.

On June 20, 1945, a historical conference on streptomycin was held in Rahway when clinical researchers from military and civilian laboratories all over the country met to compare and discuss their findings. From this meeting came the firm conviction that the new antibiotic could effectively combat urinary tract infections caused by Gram-negative micro-organisms and likewise such diseases as influenzal meningitis and tularemia (rabbit fever), both of which annually claim many human lives. The earlier work on experimental tuberculosis in guinea pigs had been definitely confirmed and when subsequently translated to human trials, streptomycin alone or as an adjunct to other established methods of treatment gave great promise of arresting certain types of this disease.

So significant were these conclusions that two months later, on the strength of recommendations of Army and Navy physicians, the War Production Board granted the necessary priorities for large-scale plant construction. Work on the Elkton, Va., plant was started in August 1945 and was in commercial production nine months later. By August 1946 it was already producing over 200,000 grams per month – which was several times the total industry-wide production prior to the time this plant started operations. Today its output is in the neighborhood of 800,000 grams per month and is steadily climbing. But we are getting far ahead of our story. Let's go back to the research laboratories where we left the chemists studying molecular structure and methods of isolation and purification.

Continued on fifth following page

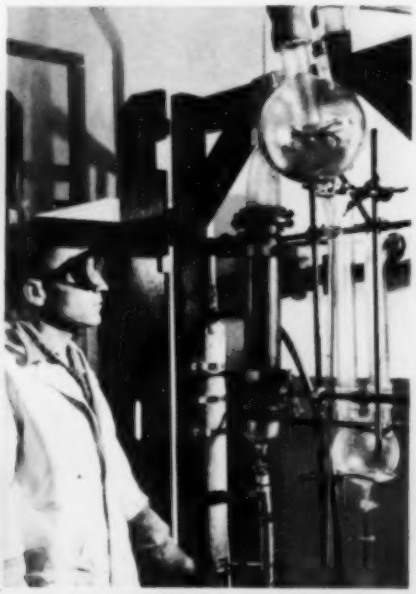
Unknown four years ago, streptomycin is making its most spectacular gains in fighting man's dreaded enemy, tuberculosis.

The Story of Streptomycin

HOW BIOCHEMICAL ENGINEERS DEVELOPED AND PRODUCED ONE OF THE WONDER DRUGS OF OUR DAY

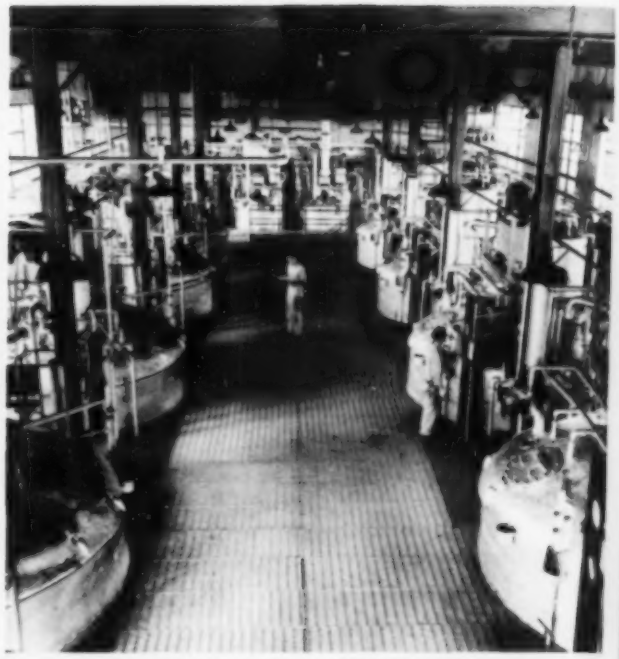
1. DISCOVERED by Dr. Selman Waksman, soil bacteriologist of Rutgers University

2. ANIMAL TESTS first inspired hopes that this discovery might benefit mankind

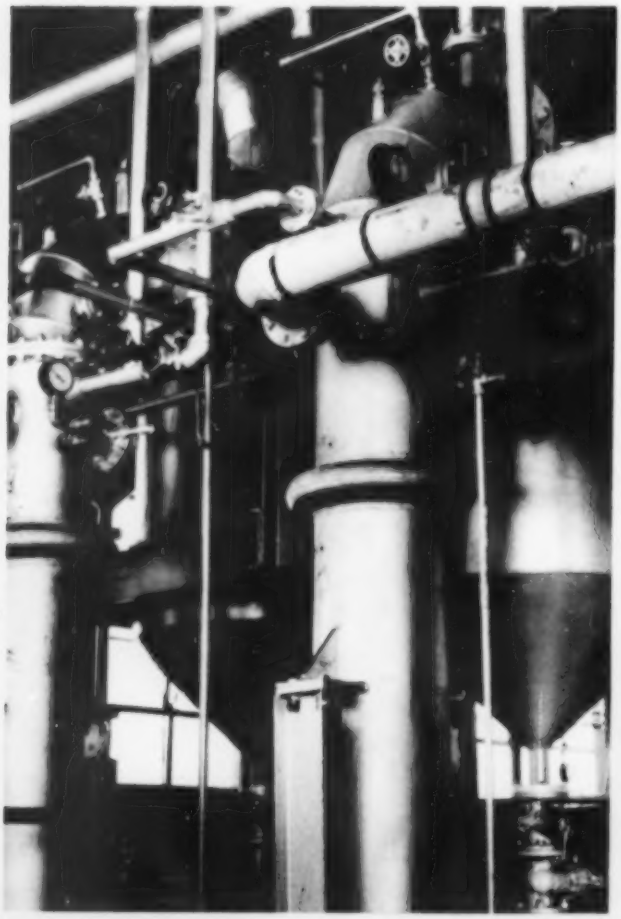


3. LABORATORY and pilot-plant research paved the way to large scale production

4. CONSTRUCTION of Elkton, Va. plant, pushed to early completion, exceed its designed capacity within a few weeks of operation

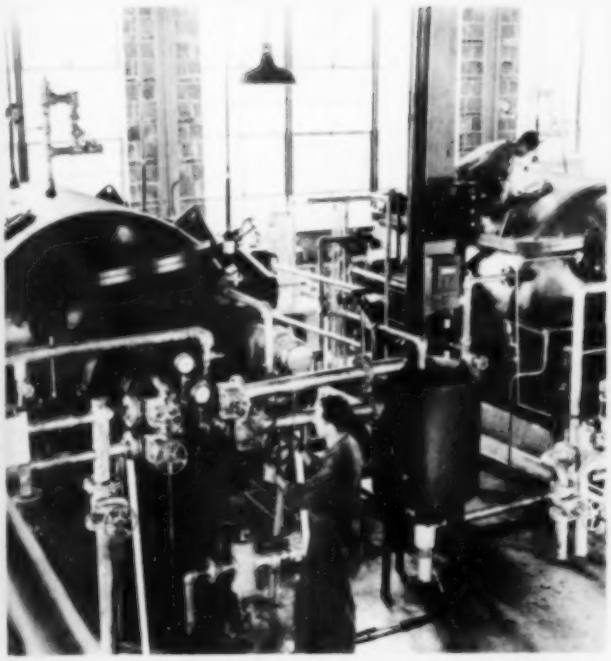


5. FERMENTATION of nutrient broth with *Streptomyces griseus* in 15,000 gallon vessels is first step in the multistage process

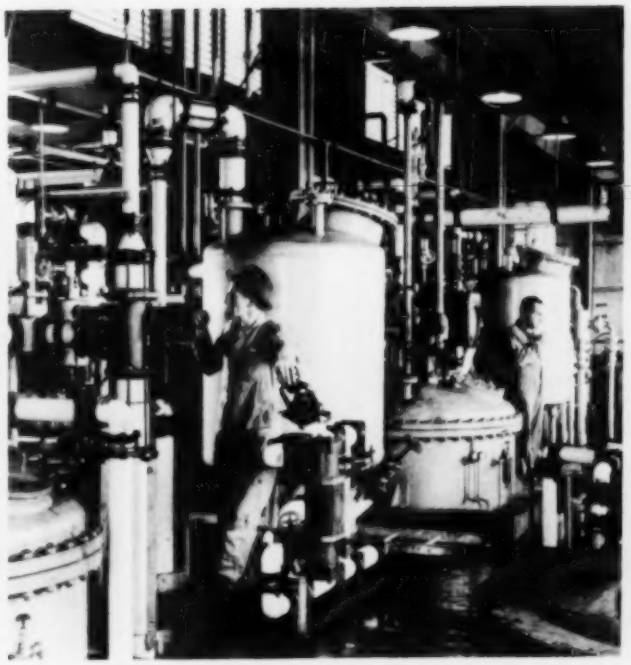


8. EVAPORATORS discharge concentrated solution from which the partly purified streptomycin is precipitated in crystalline form

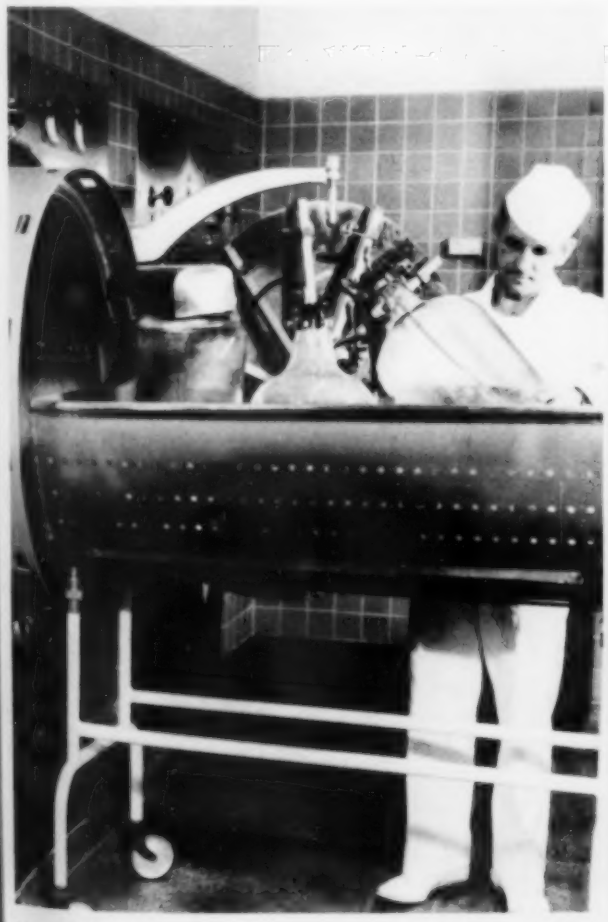
9. PURIFICATION continues in a process ending with crystallization of the calcium chloride complex salt, most pure form of the drug



6. **PRESSURE FILTRATION** starts the continuous recovery of streptomycin from the fermented liquor by the removal of waste solids



7. **ADSORBED** on activated carbon, streptomycin is eluted with acidified alcohol and filtered, all in corrosion-proof equipment



10. **STERILIZATION** of containers and equipment is the key to safe handling and packaging of the final crystalline streptomycin

11. **BOTTLE CAPPERS** automatically put final seals on approximately 800,000 one-gram bottles of vital streptomycin per month

12. **MERCK'S** new Sterile Techniques Building provides every precaution to prevent contamination and to insure purity of product

13. **RESEARCH** in all phases of biochemical engineering continues to pay big dividends in process efficiency and product improvement

14. **PROCESS CONTROL** at Elkton and Rahway requires daily analyses of thousands of samples both biological and chemical

15. **KYMAGRAPH** records blood pressure and respiratory changes produced by streptomycin, leading to wider range of usefulness

16. **POLAROGRAPHIC** analysis to determine composition, is only one of many tests that contribute to Merck's quality standards

Continued from fifth preceding page

One significant chemical discovery was that streptomycin could be readily adsorbed on activated carbon and, since it is a strong organic base, could be eluted or washed out with alcoholic hydrochloric acid. When the alcohol is evaporated, a crude hydrochloride can be precipitated with acetone, thus giving the first basis for a practical method of isolation. Subsequent improvements of this method by the organic chemists produced concentrates of higher potency, corresponding to practically pure streptomycin hydrochloride from which it was possible to determine molecular weight, empirical formula and possible structures. Simultaneously, the microbiologists were at work trying to improve the fermentation process by using more nutritive broths that would cut down on fermentation time.

Streptomyces griseus thrives best on a diet rich in protein, such as meat extract, rather than on the less expensive corn-steep liquors used for penicillin. Although the composition of the medium is exceedingly critical, nevertheless intensive research showed how some economies might be effected. This was particularly important since streptomycin, as administered by the physician, must be used in larger quantities and over longer periods than is necessary with penicillin.

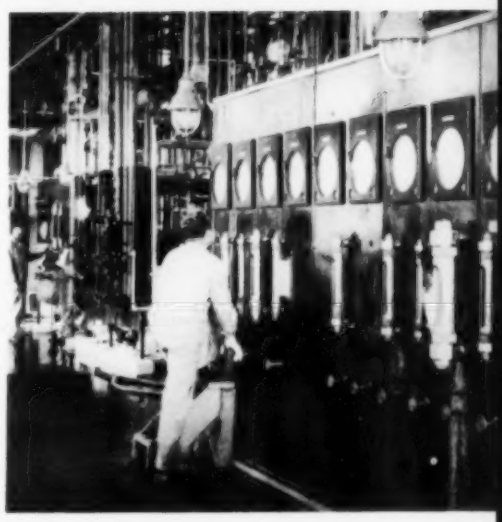
Next came a problem that was peculiarly in the province of the biochemical engineer. Clinical research and process development cannot always proceed simultaneously. Once the medical investigations are under way no change can be made in the manufacturing process unless careful, tedious microbiological assays, toxicity and other animal and chemical tests prove that such variations will not in any way affect the clinical behavior of the resulting product. Therefore, the process must temporarily be "frozen," which puts a heavy handicap on the chemical engineers responsible for developing and improving production methods. Time and time again – as reported by Dr. William H. Engels at the recent New York City symposium of the American Chemical Society on "Application Research Methods" – it was necessary to hold up the production of clinical material in order to work out a plant problem or, vice-versa, to delay development in order not to handicap the vital investigations of the clinicians. Yet all – microbiologists, chemists and engineers – were working toward the same goal, namely, maximum production of the best product at lowest cost and at the earliest possible date.

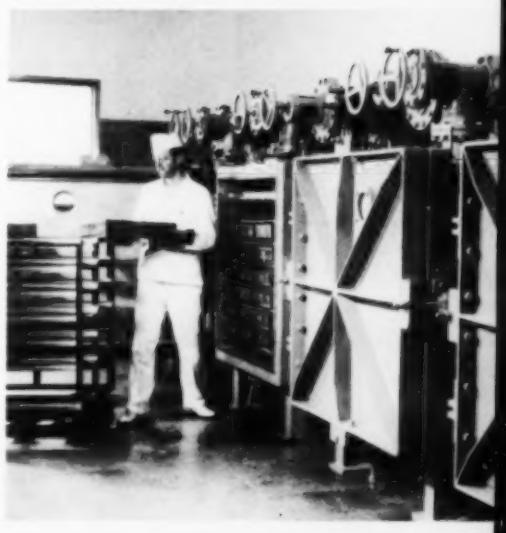
When in the summer of 1945 the decision came to proceed with the design of a large-scale plant, there were still many gaps in the process as used in the pilot plant. But the pressure was on, and through necessitous invention, the biochemical engineers succeeded in developing extraction and purification techniques differing radically from any used previously for such a process. Although the changes had first to be evaluated clinically, they passed their tests, but barely in time for the development men to keep ahead of the design and construction engineers who by the spring of 1946 were already getting production under way in the still uncompleted plants at Elkton, Va., and Rahway, N. J.

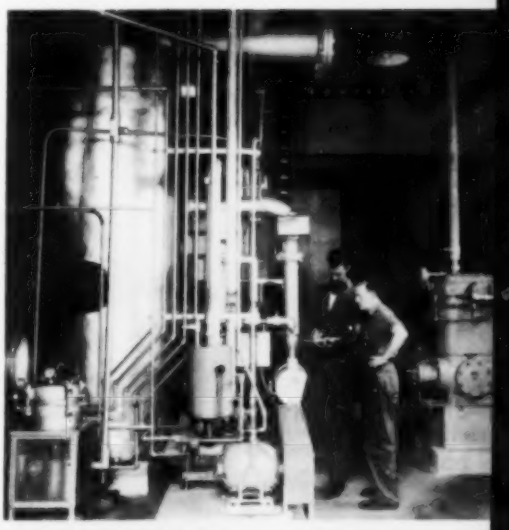
Early research had shown one possible solution for the mutual problem of the clinicians and the production engineers. It had long been Merck's experience that the more nearly pure the finished product, the less difficult it is in the long run to produce it efficiently and in uniformly high quality. From the start it was recognized that neither streptomycin hydrochloride nor sulphate could be purified as highly as desirable, yet the need for production was so pressing that the project could not wait for further research on purification processes. In the laboratory, however, it had been possible to produce a crystalline calcium-chloride complex salt of streptomycin which, by all chemical tests was practically the equivalent of pure streptomycin. Clinical tests proved it superior to even the best hydrochloride that could be produced on a large scale. So again the pressure was on the biochemical engineers. To their credit they succeeded in developing a practical and economical process. It was immediately installed at Elkton, and since July, 1947, the pure calcium-chloride complex has been Merck's sole streptomycin product. Meanwhile, by virtue of these improved techniques and mass production, Merck's management has been able to reduce the cost of streptomycin to the physician from the original $25 per gram to its present price of less than $5 per gram.

Personnel Policies and Practices

Since an important purpose of the Award for Chemical Engineering Achievement is "to encourage a broader participation of the chemical engineer in the affairs of the process industries," the Committee, in considering any group achievement, has always held it pertinent to inquire into the company's attitude toward its technical personnel. How well, therefore, does Merck measure up to the standard set by previous recipients? Our study shows that from a nucleus of a few chemical engineers 15 years ago, the company's technical staff has grown to approximately 180 men



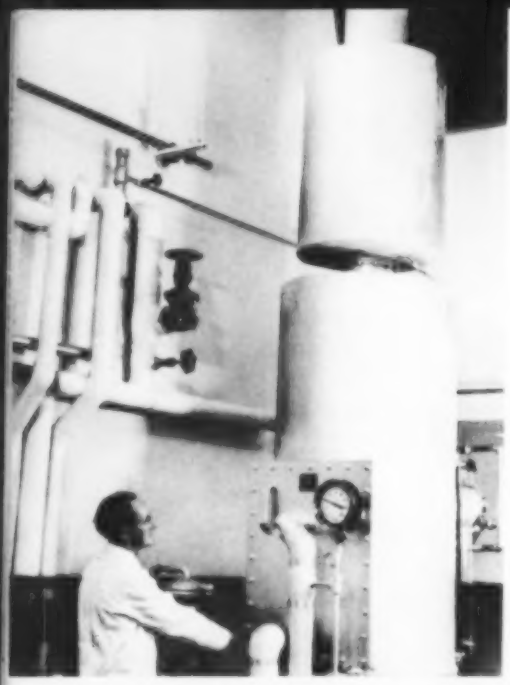


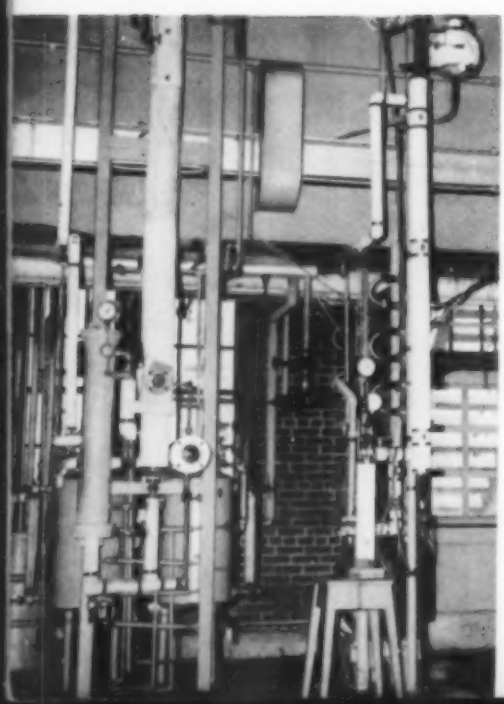


top: **PROCESS VARIABLES** are measured and automatically controlled by these instruments

center: **FROZEN** at −80 deg. C, under high-vacuum, ice evaporates leaving dried streptomycin ready for final processing

bottom: **VAPOR** from the sublimation dryer is removed as ice from the walls of this condenser





HOW MERCK'S TECHNICAL AND CHEMICAL ENGINEERING PERSONNEL PARTICIPATE IN ALL PHASES OF ITS BUSINESS

	Total Technical (Inc. Chem. Eng.)	Chemical Engineers With Degrees
RAHWAY, N. J.		
Executive and administrative	43	17
Research and development	261	37
Chemical control	76	2
Manufacturing	69	49
Sales	87	4
Engineering	41	15
Medical	17	—
Other departments	40	11
ELKTON, VA. MANUFACTURING	66	32
PHILADELPHIA, PA. MANUFACTURING	15	7
MONTREAL, CANADA	30	6
MERCK INSTITUTE FOR THERAPEUTIC RESEARCH	36	1
TOTAL	781	180

with chemical engineering training. That they are active in practically every phase of the company's business is clearly shown in the accompanying table.

More than one-third of the combined executive and administrative staffs are chemical engineers. The large group in the Research and Development Division has the responsibility for developing the chemical engineering phases of new processes, including the direction of pilot-plant operations. In the Engineering Division, chemical engineers are responsible for translating research into production by extrapolating laboratory and pilot-plant operations into full-scale commercial plants. Numerically, Manufacturing is the largest employer among the Merck departments because the majority of its operations are supervised and directed by chemical engineers. From the foregoing it is apparent that Merck's technical men are not confined to the laboratory but permeate the whole organization. Chemical engineering is not an auxiliary function, or convenience, but rather the underlying basis for all production operations and company-wide developments.

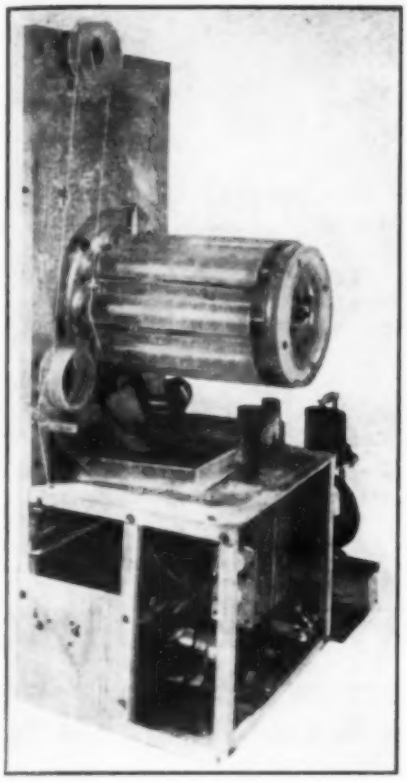
Finally, how well do such policies and practices pay off in progress and profits? Part of the answer was presented by the editors of *Fortune* in June 1947, when they pointed out that during the middle thirties Merck was just another chemical company, sharing with its competitors in a "plodding stability" and the "pleasant prejudices of the whole chemical industry that a company ought to be able to make 20 percent on its invested capital." But Merck's sales have jumped from $20 million in 1939 to $61.6 million in 1946. Today four entirely new product groups—synthetic vitamins, sulfas, DDT and the antibiotics—account for half of all sales volume and most of the $6 million of net income reported for 1947. Plant investments have mounted from $4 million in 1939 to $17.5 million in 1946, plus an additional $7 million of construction now under way. Research expenditures are in excess of $3 million per year—more than half of today's record earnings. Such expenditures will continue and increase for, again quoting *Fortune*, "research, especially in the fine chemical and pharmaceutical fields, is often a matter of spending money you don't have for a goal only dimly perceived, with the prospect of heavy plant investments long before ultimate results are assured."

Such then is the case history of what Biochemical Engineering has achieved in one progressive American industry. Its distinguished services in "organizing and controlling the forces and materials of nature for the benefit of the human race" would seem to have earned this new technology a place of honor in the engineering profession. Gentlemen, we rest our case!

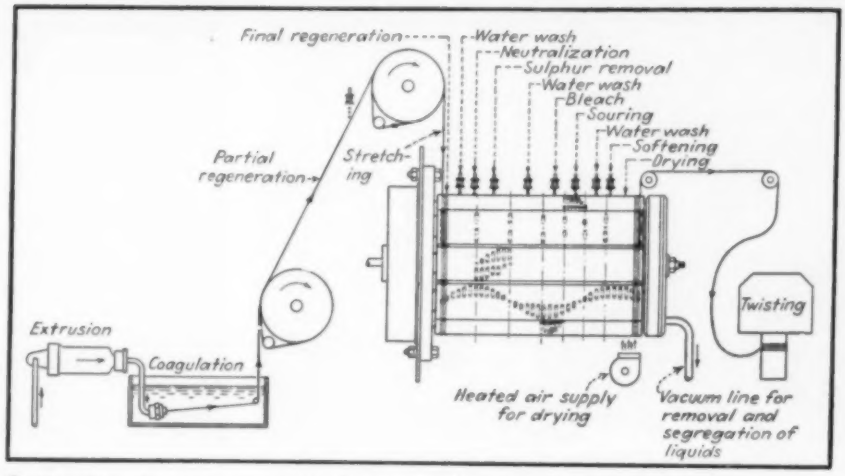
top: **STERILE, pyrogen-free water used in finishing operations is produced by distillation**

center: **VIALS, each of which will contain one gram of streptomycin, are washed and sterilized**

bottom: **UNIT OPERATIONS for fine chemical processes are studied in Merck's chemical engineering laboratories in Rahway, N. J.**



1 Kuljian continuous spinning machine



2 Treating steps are concentrated on a small roller drum as shown here

Continuous Rayon Spinning Process

VISCOSE, WET ACETATE AND CUPRAMMONIUM RAYON SPINNING CAN BE HANDLED WITH A NEW MACHINE

A HIGH DEGREE of simplicity, coupled with probable savings in floor space, capital investment and operating cost, characterize the new continuous spinning machine developed by Harry A. Kuljian, president of H. A. Kuljian & Co., engineering and constructing firm of Philadelphia. Reported to be more versatile than earlier continuous machines, the new type is said to be equally suitable for viscose, wet-spun acetate and cuprammonium yarns. A particularly advantageous feature is the ability to segregate, and to a large extent, to recover, the various solutions used in treating the freshly spun yarn.

The heart of the Kuljian machine, which is fully covered by patent applications, is a novel "roller drum" over which the freshly spun yarn is uniformly distributed for completing the regeneration and carrying out the washing, desulphurizing, bleaching and drying. This drum consists of a group of eight rollers with their axes parallel but skewed slightly so that as the rollers revolve the yarn leaving any roller along a tangent to the roller strikes the next roller at a point slightly nearer the discharge end of the machine. The effect of this ingenious device is to cause the loops of yarn on the drum to spread out like a screw thread and advance continuously.

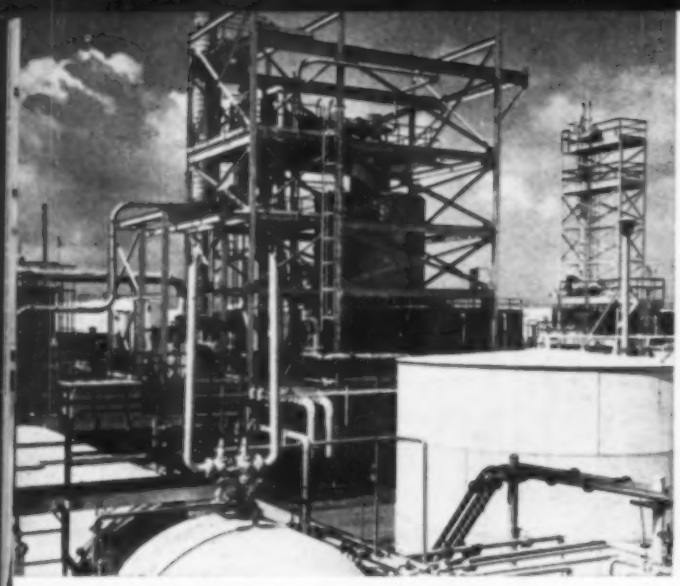
The amount of skew of the rollers is, in fact, adjustable while the machine is running so that the pitch of the yarn on the drum can be varied to give any desired detention. This is accomplished very simply. In Fig. 1 it will be evident that the drum—which is constructed largely of methylmethacrylate plastic—consists of the eight rollers supported at their outboard ends by sealed bearings housed in a plastic ring. The ring in turn is carried on a plastic cantilever extending through the drum from the back of the machine. A cam arrangement permits the ring to be rotated slightly, skewing the rollers to the desired pitch.

How It Operates

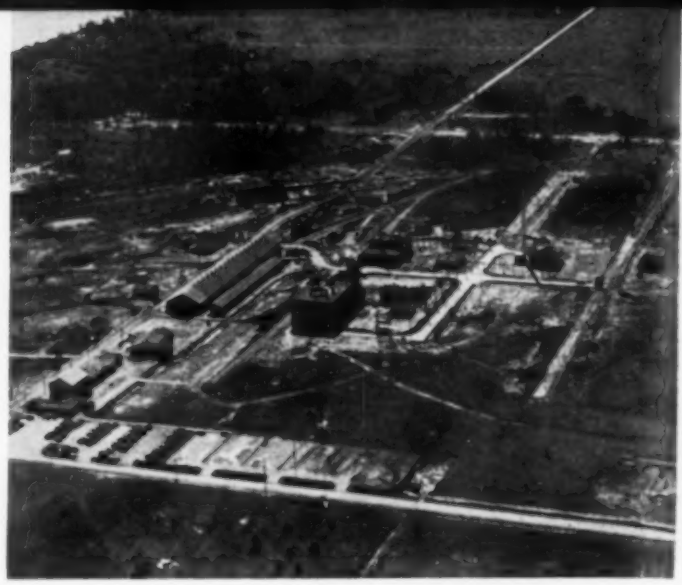
In operation spinning solution is extruded and coagulated in conventional equipment and the yarn led over a pair of godet wheels to the roller drum. If desired H_2SO_4 can be dripped on to the yarn between the godets to hasten regeneration, which is completed in the first few turns on the drum. Between the second godet and the drum any desired stretch can be applied by a suitable choice of relative surface speeds. On the drum proper the necessary sequence of treating steps is applied by dripping the various solutions on to the yarn and then removing these solutions by means of suction applied through holes drilled in the rollers at the proper points. In the case of viscose yarn a usual sequence would be a water wash following the completion of regeneration, as in Fig. 2, then neutralization with NaOH, if needed, followed by desulphurization with sodium polysulphide, a water wash, bleaching with sodium hypochlorite, souring with HCl, if needed, a water wash, softening with soap solution and soluble oil, and finally, drying with hot air, or electrically.

If the yarn is to be shrunk, any desired shrinkage can be provided by a suitable taper of the drying section of the rollers. Then the yarn leaves the drum and is twisted conventionally.

Ability to segregate and recover the various solutions is imparted by drilling the rollers centrally and inserting a slotted plastic rod in the hole. With the rod held stationary and its slot connected to an evacuated reservoir, suction is applied to the surface of the roller through small radial holes, but only when each hole rotates over the slot. By arranging these holes spirally over a short length of roller practically all solution applied in that length can be drawn off and recovered, the slot and spiral lessening the vacuum load. To achieve segregation of the various solutions, each can be withdrawn on a different roller, producing little mixing with adjacently applied solutions.



HOUSTON This Shell Chemical Corp. unit concentrates sulphuric acid. Shell makes alcohols and ketones



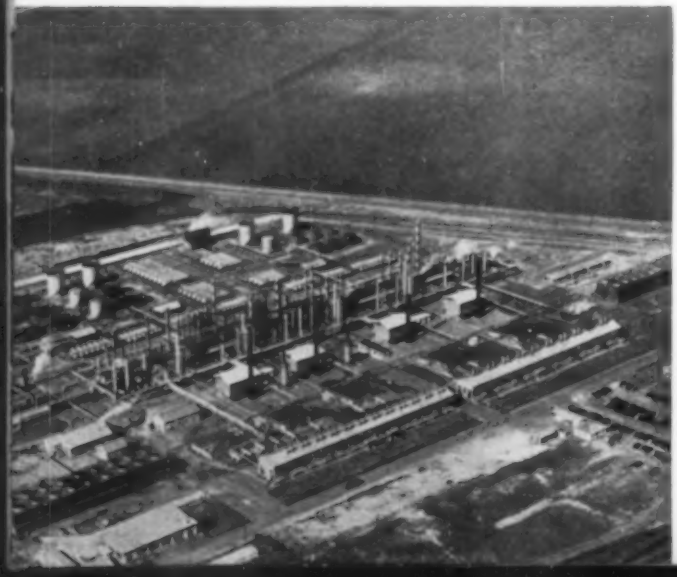
LA PORTE Vermifuges, fungicides and soil disinfectants will be made at this plant of Du Pont's Grasselli Chemicals Dept.

New Skyline

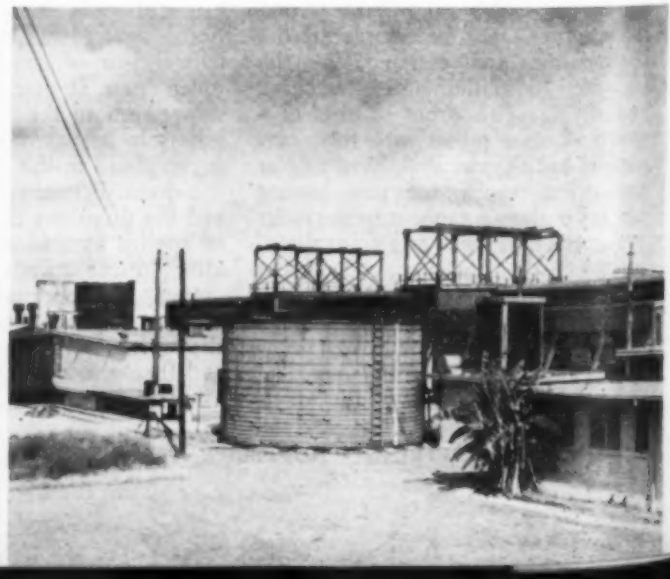
J. V. HIGHTOWER
Southwestern Editor, *Chemical Engineering*

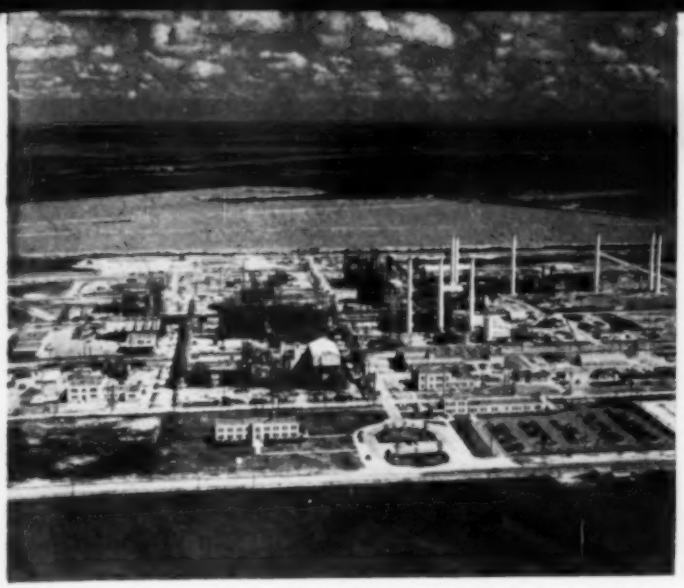
TEXAS CITY First fractionating tower goes up at Monsanto's styrene plant

BISHOP Building continues at this Chemcel plant where the Celanese Corp. of America makes organics



CORPUS CHRISTI Laboratory and pilot plant buildings at Southern Alkali Corp.'s new research and development center





ORANGE Now making nylon salt, Du Pont's Sabine River Works will soon produce polythene and methanol in units now going up

BATON ROUGE Jersey Standard refinery. Three "cat crackers," alkylation unit and light ends plant

for Old Southwest

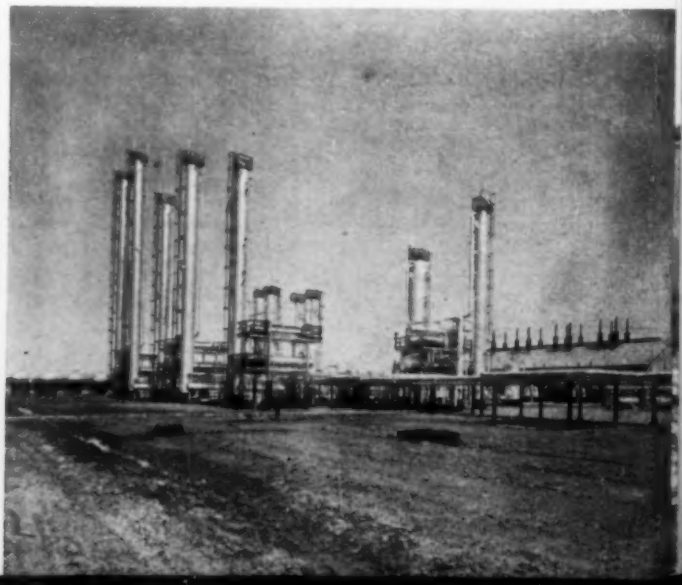
FROM DEEP IN THE HEART OF TEXAS COMES THIS PICTORIAL ROUND-UP ON THE POSTWAR CHEMICAL PLANT CONSTRUCTION BOOM

The chemical industry came to the Southwest during the war and has decided to stay. It is growing both in size and diversity at a remarkable rate. Most of the postwar expansion is centered in the Gulf Coast region, where cheap natural gas, an abundance of chemical raw materials in the form of petroleum, salt, sulphur and lime, good transportation and an important local market for chemicals in the constantly growing petroleum refining industry are irresistible attractions to chemical manufacturers. New manufacturers are appearing here and promise to offer stiff competition to older companies.

THE BOOM in chemical manufacturing which the war touched off in the Southwest continues unabated. Since Japan quit in 1945 it is estimated that the new investment in chemical plants, in terms of completed construction and construction actually under way amounts to $240 million. The comparable figure for petroleum refining, including recovery of natural gasoline and associated hydrocarbons, is estimated at $119 million. The total, $359 million, represents almost entirely expansion along the Gulf Coast, where wartime construction in

BAYTOWN Work is in full stride on Humble Oil & Refining Co.'s new plant for solvent dewaxing of lubricant charge stocks

WINNIE Natural gasoline plant owned by Absorption Plant, Inc., a Glenn H. McCarthy affiliate



HOUSTON Diamond Alkali's $11 million caustic plant will have its first unit operating next spring

BATON ROUGE New construction is under way at this Ethyl Corp. plant as part of a $20 million expansion program

this category totaled some $325 million.

The southwestern boom is based on a felicitous combination of factors which sooner or later had to be recognized. The presence of cheap natural gas for fuel and chemicals production, deep water transportation and an abundance of basic raw materials has been a combination offering a particularly strong inducement to manufacturers to locate in the Gulf region. An ideal element in this situation is the mutual advantage to be enjoyed by chemical manufacturers and numerous large petroleum refineries located in close proximity. This makes possible a profitable exchange between the two groups, the refiners furnishing a wide range of hydrocarbons to the chemical plants for processing and the chemical manufacturers in turn selling large quantities of chemicals (*Chem Eng.*, Jan. 1946) to the refineries.

Petrochemicals

The processing of petroleum raw materials is playing an impressive role in this postwar development. Of the $240 million investment program in plants manufacturing chemicals and related products, some $179 million, or about 75 percent, represents investments in plants consuming petroleum materials entirely or for the most part. Companies spending heavily in this field are Shell Chemical Corp. at Houston, Tex., Carbide & Carbon Chemicals Corp. at Texas City, Tex., Dow Chemical Co. at Freeport, Tex., Ethyl Corp. at Baton Rouge, La., Jefferson Chemical Co. at Port Neches, Tex., Carthage Hydrocol, Inc., at Brownsville, Tex., the Monsanto Chemical Co. reconstruction at Texas City, McCarthy Chemical Co. at Winnie, Tex., Celanese Corp. of America at Bishop and Corpus Christi, Tex., Rohm & Haas at Houston and du Pont at Orange, Tex.

Smaller but no less significant investments are being or have been made since the war by Commercial Solvents Corp. at Sterlington, La., Gulf Chemical Co. at Houston, du Pont at La Porte, Tex., and Lion Oil Co. at El Dorado, Ark.

When to the $179 million investment figure for chemical plants operating on petroleum materials is added the $119 million outlay for petroleum and recovery of natural gasoline and associated liquid hydrocarbons, the total is $298 million. This constitutes 83 percent of the grand total of $359 million invested or being invested by chemical companies and petroleum refiners since the war.

Of great interest in the field of chemicals synthesized from petroleum gases is the $18 million plant at Brownsville, Tex., which Carthage Hydrocol is building for the manufacture of synthetic high-octane gasoline, alcohols and other products. This is the first large-scale plant in this country to utilize basic principles of the Fischer-Tropsch process. Of equal interest is another pioneering job, the $8 million synthetic glycerine plant which Shell Chemical Corp. expects to put into operation at Houston next year.

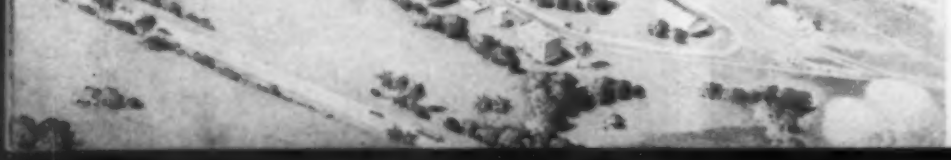
Carbide & Carbon Chemicals Corp. began last fall as additions to its Texas City plant the construction of units for the manufacture of vinyl resins. These new facilities, located west of the company's present site, between La Marque and Texas City, form part of a $15 million building program. In addition, this company has just completed a large unit, also at Texas City, for production of ethylene amines. These projects represent an extension of a plant expansion program begun in 1945, which includes construction of a unit for the manufacture of butyl alcohol and increased capacity for production of industrial organic solvents and anti-freeze compounds.

Salt, Lime and Sulphur

The continued heavy demand for chemicals made from salt, lime and sulphur, coupled with the presence in large quantities of these three basic materials along the Gulf Coast, accounts for approximately $20 million in current construction. Diamond Alkali expects to put into operation next spring the first unit of its $11 million caustic plant at Houston and will complete the project during 1948. At Lake Charles, La., Mathieson Alkali is installing $4.25 million in new equipment which will expand its production of soda ash by 90 percent by next summer. Dow Chemical has projected an investment of several million dollars in a caustic unit near Freeport, Tex. Scheduled for completion late this year is the new $1 million sulphuric acid unit in the Houston plant of Consolidated Chemicals.

Purchase this year of the Myles Salt Co. and Bay Chemical Co., both in Iberia Parish, La., by the Morton Salt Co. is a probable forerunner of an expansion program in sodium chemicals by Morton, whose president has said

CORPUS CHRISTI To start up next year, Corn Products Refining Co.'s new plant will convert 20,000 tons per day of milo maize into oils



HOUSTON Although still in its early stages, construction at this newest plant of the Rohm & Haas Co. goes forward rapidly

TEXAS CITY Part of Carbide & Carbon's $15 million expansion will add vinyl resin capacity here

that the two acquisitions were made in order to open the way to diversification of products by the parent company. Bay chemical has been manufacturing sodium sulphate and hydrochloric acid.

At Corpus Christi, Southern Alkali, having bought from the government the land, buildings and equipment used by American Cyanamid during the war to manufacture aluminum chloride, is converting the property into a research and development center. The company intends to diversify its products and develop new applications for them. Southern is at present manufacturing caustic soda, caustic potash, chlorine, pulverized calcium oxide, soda ash and dry ice.

New Companies

The entry of new chemical companies which have not heretofore been in production is one feature of the postwar expansion in the Southwest. In addition to Carthage Hydrocol, Jefferson Chemical Co. is one of the large new organizations. Owned equally by The Texas Co. and American Cyanamid, the company has substantially completed at Port Neches, Tex., the first units of a plant, probably valued at more than $20 million, to manufacture ethylene oxide, ethylene glycol and perhaps other chemicals from refinery gases piped 7 mi. to the plant from the refinery of The Texas Co. at Port Arthur. American Cyanamid has also acquired some 900 acres adjacent to Jefferson.

Another ambitious newcomer is McCarthy Chemical Co. Near the natural gasoline plant of Absorption Plant, Inc., one of the Glenn H. McCarthy interests, at Winnie, 30 mi. southwest of Beaumont, Tex., McCarthy has started construction of what is planned as an $8 million plant to manufacture a line of organic chemicals from natural gas components.

Also entering the lists is Gulf Chemical Co., which will manufacture a line of phosphates in a $1 million plant being built outside Houston. The company has announced that its products will include mono-, di- and trisodium phosphates, sodium acid pyrophosphate, sodium polyphosphates, tetrasodium pyrophosphate, special calcium phosphates and defluorinated rock phosphate. Plant capacity, in terms of disodium phosphate equivalent, is rated at about 72 tons per day.

A new company, Oklahoma Chemical Co., has been formed by the Missouri Chemical Co. and the Ozark Chemical Division of the Ozark-Mahoning Co. to erect a $300,000 plant near Tulsa for the manufacture of superphosphate. The projected capacity is 50,000 tons per yr. of superphosphate, most of which will be sold in the form of mixed fertilizers. The plant is expected to be completed next year.

Reflecting the large worldwide demand for oils and fats, several companies are investing approximately $15 million in this field. The principal figure is Corn Products Refining Co., which will put into operation next year its $14 million plant at Corpus Christi to convert 20,000 tons per day of milo maize and probably other grains into oils and other products. Helena Cotton Oil Co. at Helena, Ark., completed this year its $300,000 cottonseed solvent extraction plant. At Abilene, Tex., West Texas Cotton Oil Co. also erected this year a cottonseed extraction plant. Delta Products Co. became the first to operate a commercial plant for continuous solvent extraction of cottonseed when it began operations at Wilson, Ark., last spring.

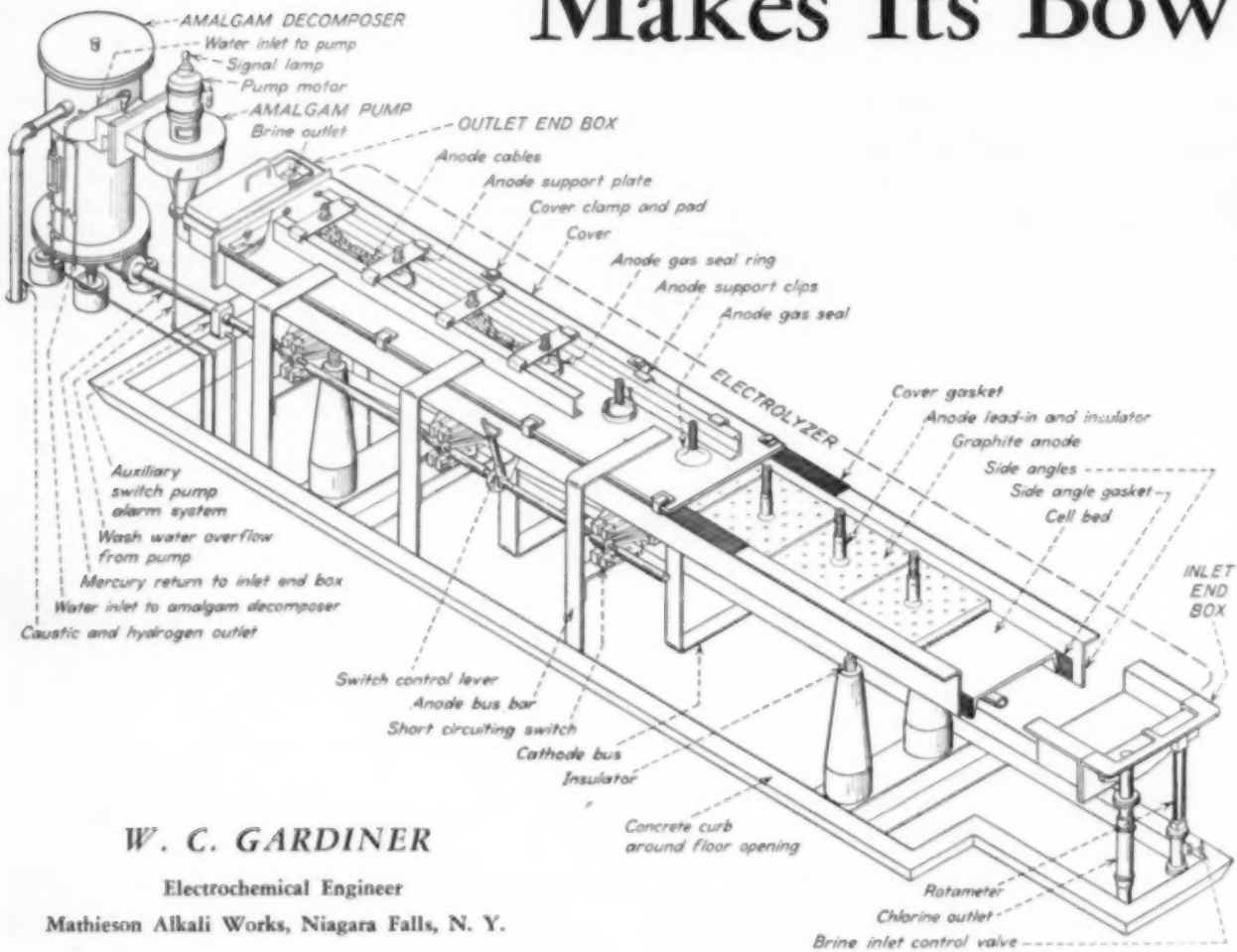
It is estimated that new chemical plants planned but not yet begun represent an investment of about $15 million. The major project in this class is that of Stanolind Oil & Gas Co., which is reported as planning a $12 million plant near Carthage Hydrocol at Brownsville to process the alcohols and other byproducts from the Carthage operation. There is good prospect that Corpus Christi will see the construction of a cement mill and a glass plant begin in that area next year.

Lubricant Plants

The petroleum refining industry is pushing rapidly a large program of construction of lubricant plants utilizing solvent treating. At its Baytown refinery, Humble Oil & Refining Co. has an MEK-benzol dewaxing unit, costing approximately $4.5 million, nearing completion. Near Houston, Shell Oil Co. is installing a propane deasphalting and phenol extraction unit. The Texas Co. at Port Arthur expects to complete by 1949 a new lubricant plant involving solvent refining with furfural and dewaxing with MEK. Magnolia Petroleum Co. at Beaumont is engaged in a large lubricant program which includes two solvent refining units. Sinclair Refining Co. at Houston is also expanding its lubricant manufacturing capacity. The Citcon Corp. plans a huge $30 million solvent refined lube oil plant at Lake Charles.

PORT NECHES When completed this $20 million plant of Jefferson Chemical Co. will produce ethylene oxide and ethylene glycol from refinery gases

New Mercury Cell Makes Its Bow



W. C. GARDINER

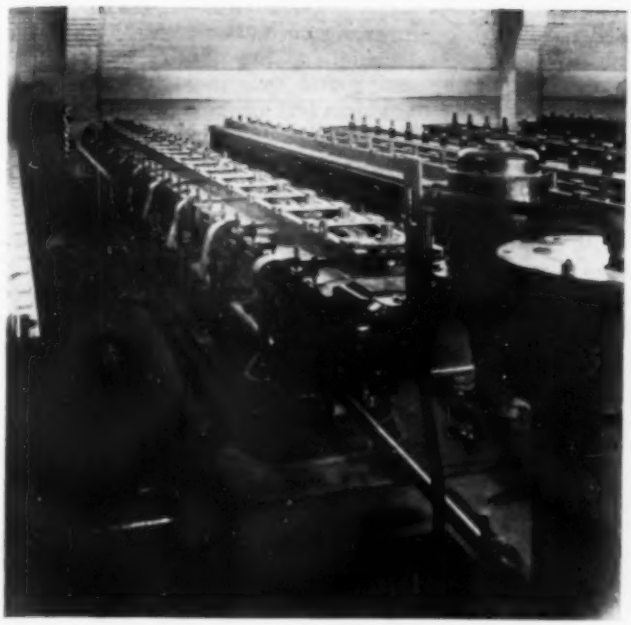
Electrochemical Engineer

Mathieson Alkali Works, Niagara Falls, N. Y.

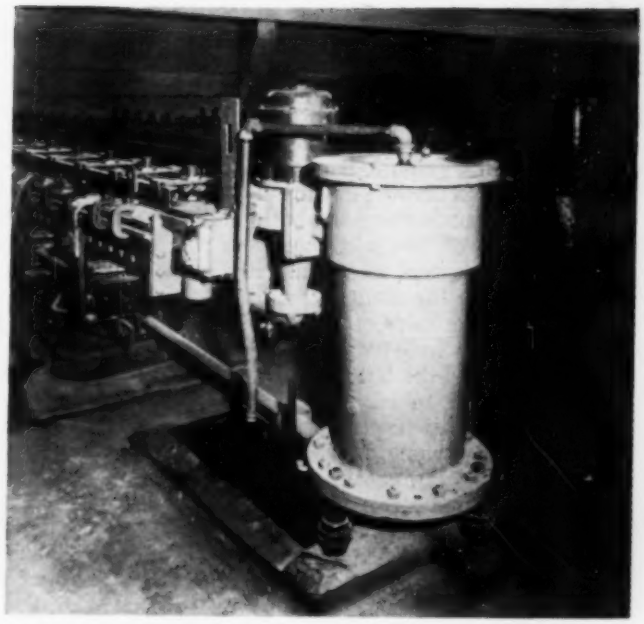
THE FIRST COMMERCIAL INSTALLATION OF A MERCURY CELL DEVELOPED BY MATHIESON IS NOW IN OPERATION

Rapid increase in demand for chlorine and caustic soda has greatly increased interest in the alkali industry and in electrolytic cells. Availability of the new German mercury cells for observation and study has brought this type of cell to the forefront. Interest will be further kindled by this first description of a mercury cell that has been quietly undergoing development in this country and which has certain advantages over the German cells that are discussed.

IN 1895 Mathieson Alkali Works installed Castner rocking mercury cells to produce one ton per day of caustic soda at the Saltville, Va., plant. Two years later, a plant to make 30 tons per day of caustic soda was put in operation at Niagara Falls, N. Y., using Castner rocking cells. Through the years the cell and process have undergone continuous improvement. In the early 1930's, experimental work was started on the production of other chemicals besides



Larger Mathieson cell developed with Aluminum Co. of Canada to fit existing facilities at Arvida, Quebec



Tower type amalgam decomposer can be seen in foreground with mercury pump and part of electrolyzer

caustic soda from sodium amalgam, which is an intermediate product of electrolysis in the cell. Early experiments indicated that the rocking type of cell was not desirable for some amalgam-using processes. For this reason, the development of large capacity cells of the stationary type was undertaken.

A survey was made of the European stationary mercury cells that were in operation at that time. A comparison of the operating data on these European cells with the rocking cells at Niagara, indicated that they could not compete economically with the rocking cells for the production of caustic soda. It was decided that a better cell could be developed, based on rocking cell experience.

Small Stationary Cell

A small stationary type of mercury cell was first built and operated to use both the brine and electrical facilities of an existing rocking cell circuit. While the mechanical details of this small stationary cell were being worked out, various types of brines and methods of obtaining them were investigated and tested in pilot plant operation on one or more rocking cells. The next step was to test a stationary cell of greater capacity. A larger cell was built and installed in a pilot plant where various methods of brine treatment could be tested and current up to 10,000 amp. was available. A motor generator set was first used but this was eventually replaced with selenium rectifiers making 20,000 amp. available for cell development. A cell rated at 10,000 amp. was in production making sodium methylate for several years while the staff was occupied with war work.

It was found that the Germans had developed a horizontal type of mercury cell and a vertical type of cell. The former type was considered to be fully developed but the latter was still experimental although used for commercial production in three plants. The purpose behind the vertical cell development was to conserve floor space and to develop a design adaptable for high unit production. The operating costs of the vertical cell plants were considerably higher than those having horizontal cells. After further development the vertical design may have an advantage over the horizontal type for some conditions, particularly for very large installations. By comparison, it may be concluded that the Mathieson mercury cell process has some very definite advantages over the German practices. The advantages of the Mathieson process may be summarized as follows: (1) Calcium sulphate can be tolerated in the Mathieson process thereby avoiding the use of barium carbonate which is usually expensive, (2) the Mathieson cell requires only 60 percent of the floor space of the German horizontal cell, (3) this American cell uses cheaper structural steel members than the German horizontal cell, and (4) the anode construction of the Mathieson cell gives a lower energy consumption by about 15 percent, at equal current densities. On the other hand valuable information was obtained from the Germans on brine dechlorination equipment and mercury pumping. Since these features are not covered by patents, they have been incorporated in the latest Mathieson cell design and the dechlorination of brine can be applied to those locations where this technique is necessary. The Mathieson Alkali Works decided to license the use of their mercury cell process and it has been made available to several companies.

Description of Mathieson Cell

In the mercury cathode type of alkali and chlorine cell, brine is decomposed in one compartment, called the electrolyzer, by passing direct current between a graphite anode and a mercury cathode thus forming chlorine and sodium amalgam. The amalgam is transferred to a second compartment, the amalgam decomposer, where sodium is made to react with water to form hydrogen gas and sodium hydroxide solution. Pure water is fed into the amalgam decomposer to make a solution containing up to 50 percent sodium hydroxide. In the stationary or horizontal type of mercury cell the mercury flows along the bottom surface of the electrolyzer, which has a slight slope towards one end, where it separates from the brine in an outlet end-box and is transferred to the amalgam decomposer. After the amalgam is decomposed, the mercury is returned to the upper end of the electrolyzer which it enters through the inlet end-box. A mercury pump may be in-

stalled either before or after the amalgam decomposer but in the Mathieson cell it is located between the electrolyzer and decomposer.

In the electrolyzer, brine is decomposed into chlorine and sodium amalgam, between a graphite anode and a mercury cathode flowing down a sloping steel surface forming the bottom. The bottom of the electrolyzer is formed by a channel set on insulated pedestals with the flanges pointing downward. The sides of the electrolyzer are made from rubber covered angles, bolted to the bottom channel, sealed with soft rubber gaskets. No trouble has been experienced with mercury leakage along this joint. The cover for the electrolyzer is also made of rubber-covered steel suitably reinforced for stiffness. The cover is clamped to the side angles using a soft rubber gasket to give a gas-tight closure.

The anode construction has been an important development in the cell design, as it is mainly responsible for the low power consumption compared to other mercury cells. The main features of this anode design are: (1) A means of readily adjusting the anode-to-cathode distance with or without the cell current being interrupted, (2) a protected copper lead-in to the graphite anode, and (3) adequate means for allowing chlorine to escape from the bottom surface of the graphite anode.

Adjustable Anode

Adjustability of the anode is achieved by supporting it from the anode adjusting nut, using a flexible cable for the current connection and a gas seal of flexible rubber. Thus the anode is free to move vertically by turning the adjusting nut. The lead-in is a length of brass or copper pipe of the economical cross-section, threaded at the top for the adjusting nut. A lead button is cast on the bottom of the lead-in and threaded. The graphite is drilled and tapped to receive the lead thread of the lead-in. Before assembly, the graphite around the hole is impregnated to prevent chlorine from attacking the lead threads. The lead-in is protected by means of a porcelain pipe from attack by chlorine. In order to facilitate the release of gas from the bottom of the anode, slots are cut in the graphite and several holes are drilled through the graphite above each slot to allow the chlorine to get to the upper surface of the anodes.

Each cell is provided with a cut-out switch so that the cell can be short-circuited. Bus bars run from cell to cell, there being one bus bar for each pair of anodes. Because of the multiple number of bus bars, a special switch was designed with a contact for each bus bar, all being interconnected mechanically so that all contacts open or close simultaneously. The pedestals for supporting the electrolyzer support the bottom channel at four or six points, depending on the length of the electrolyzer.

Amalgam Decomposer

The sodium amalgam formed in the electrolyzer is pumped to the top of the amalgam decomposer which is of the tower type but operated in a novel manner. Since amalgam decomposition is due to a large number of short-circuited cells in which the amalgam is anode and the graphite is cathode, the shorter the anode-to-cathode distance the more efficient is the decomposition. In the present design, the tower is flooded with amalgam and the water or solution must force its way in a very thin film between the amalgam and graphite surfaces thereby having a minimum resistance drop between anodic and cathodic surfaces.

The tower is made from standard steel pipe with the packing held tightly between screens. There is a mercury distributor at the top of the tower and a mercury collector at the tower bottom. The amalgam enters the top of the decomposer through a seal. Pure water is introduced near the bottom of the decomposer. Mercury or dilute amalgam from the bottom of the decomposer returns through a pipe to the inlet end-box at the upper end of the electrolyzer. The caustic soda and hydrogen formed in the decomposer leave through another pipe. The decomposer is made of steel or iron and it was a surprise to find that caustic soda of very low iron content could be made, apparently because the steel surfaces become amalgamated very quickly. At some stages of the development, 73 percent caustic soda was made in this type of decomposer but difficulties in controlling the water flow and in handling such concentrated caustic soda from multiple units have discouraged attempts to make higher than 50 percent caustic soda directly. One benefit of operating the amalgam decomposer flooded with amalgam is that the head required for pumping the mercury is very low.

Throughout the development of this stationary cell, a mercury pump was used having an outer conical casing with an impeller consisting of a paddle rotating on a vertical shaft. The rotary motion given to the mercury or amalgam by the paddle caused it to climb up the sides of the conical casing and spill over the top. The Germans had a similar pump in which the impeller was a spinning cone. The two types have been tested and the American made paddle impeller was found to require considerably less mercury. In this cell, water is added dropwise to the pump compartment. This solution, which washes out any sodium chloride that may accompany the amalgam, overflows from the pump and is collected for use in brine treatment.

The mercury pump motor is preferably a directly connected 420 rpm. motor. However, a gear motor may be used at some saving in first cost. A signal light is used to give a warning if the mercury pump motor fails.

Inlet End Box

The inlet end-box closes one end of the electrolyzer and has a mercury distributing groove as well as the brine inlet and the chlorine outlet. It is made of rubber-covered cast iron or steel.

At the right hand end of the electrolyzer is the outlet end-box. This is an intermediate section between the electrolyzer and the mercury pump. The essential function of the outlet end-box is to separate the sodium amalgam from the brine. A partition extending from the top to below the brine surface also separates the gas space in the electrolyzer from the gas space in the end-box. Sodium amalgam leaving the electrolyzer flows into a groove across one end of the outlet end-box and into a pipe leading to the mercury pump. A relatively quiescent pool of sodium amalgam is formed in this groove which has the important function of allowing impurities in the amalgam to float to the surface where they collect and are periodically removed by skimming. The outlet end-box has a readily removable cover for inspection and for carrying out the above mentioned skimming operation. The brine leaves the end-box through a pipe extending up through the bottom. Suction is provided in connection with the outlet brine piping to ventilate the end-box.

Cell Operation

In normal operation treated brine is fed to the cell at approximately 60 deg. C. at such a rate that it will overflow from the cell at 270 grams per liter of NaCl. This will require approximately 1 ml. of brine per ampere of cell current. The amalgam is cir-

culated through the cell at such a rate that it contains approximately 0.15 percent sodium entering the amalgam decomposer. The rate of amalgam circulation with the type of pump that is used is governed by the amount of mercury in the cell. The chlorine is removed with a slight suction of approximately 0.25 in. of water. Pure water is fed to the amalgam decomposer using a rotameter and a needle valve to control the rate. The caustic soda is checked periodically to make sure that the proper concentration is being produced.

The important criterion of good cell operation is the concentration of H_2 in Cl_2. Under normal operating conditions the H_2 in Cl_2 should be 0.2-0.5 percent, but any deviation from the optimum operating conditions will increase this H_2. Since H_2 in Cl_2 becomes explosive at 5 percent if exposed to sunlight or a spark, it is imperative to find and remedy the condition before this explosive limit is reached. The factors which might contribute to increased H_2 in Cl_2 include impure or diluted brine, too low a brine rate, incomplete removal of sodium from the amalgam in the amalgam decomposer, a slowing up of the rate of amalgam circulation so that the sodium concentration becomes too high, too high a brine temperature, and pieces of graphite from the anode touching the mercury.

Anode Maintenance

The life of a set of anodes depends on the current, but at rated capacity it should be approximately seven months. A complete assembly of anodes in the cell cover is prepared in a jig at the end of the cell room so that the used anodes and cover can be removed and replaced with a minimum of lost production. When the anodes are being removed, the cell is also cleaned. Anodes are also adjusted approximately once a week by turning the adjusting nut on each anode a fraction of a turn. The current distribution to each anode is also checked with a milli-voltmeter at this time and any wide deviation calls for a further adjustment of the particular anode.

After cell cleaning, the anodes are adjusted by dropping each one in turn to the cell bottom and then lifting it up to the required height by the proper number of turns on the adjusting nut.

The original cell design rated at 10,000 amp. having 16 anodes has been operated up to 18,000 amp. but 15,000 amp. is probably the highest that would be practical. It is now nominally rated at 12,000 amp. In order to accommodate certain conditions in a plant now starting construction a cell 25 percent larger, having 20 anodes was designed and this is now available. Larger cell designs are contemplated. The operating characteristics of these two cell designs are summarized in Tables I-IV. The current efficiency of the cell averages slightly higher than 96 percent but approximately 1 percent is allowed for brine treatment so the process is only credited with 95 percent current efficiency.

The mercury content of either cell is comparatively high because the seals were made large to insure purity of product. The transfer of mercury in pipes requires more mercury but saves floor space.

Operating at a high temperature has the bad effect of increasing H_2 in Cl_2 and increasing the rate of anode corrision but, on the other hand, a high temperature improves amalgam decomposition and cell voltage. It is practical to regulate the cell variables so that the brine leaves the cell at approximately 75 deg. C. This is not only a practical maximum temperature for cell operation, but also for an economical life of the rubber lining that is used for the cells and brine handling equipment.

At present, it is recommended that the cell operate at 2.5 amp. per sq. in. but some data indicate that 3.0 might be more economical. The cell has been operated successfully up to 3.5 amp. per sq. in. The economic current density is a complex subject and is different for each location, depending upon the cost of power and interest charges on the investment in buildings and equipment. Increasing the current density on an existing installation is particularly desirable for increased output as an increase in investment is required mainly for electrical equipment while many operating cost items, such as labor, remain the same thereby reducing unit costs.

The relation between current density and the average cell voltage is given in Table I.

Brine is normally fed to a cell at a concentration just under saturation for the lowest temperature in the system. Normally the rate of brine feed will be such that the outlet brine contains

Table I—Operating Data on Two Sizes of Mathieson Stationary Mercury Cells

		16-Anode Cell			20-Anode Cell		
Cell dimensions		28 ft.-8 in.x2 ft.-3in.			34 ft.-6½ in.x2 ft. 3in.		
Mercury in cell, lb		1,700			1,900		
Wt. of graphite anodes (17¾ in. x 17 in. x 2½ in.), lb		680			850		
Cell wt. (including mercury), lb		11,700			13,200		
Current, amp		5,000	10,000	12,000	6,250	12,500	15,000
Current density, amp. per sq. in.		1	2	2.4	1	2	2.4
Cell voltage, average		3.73	4.11	4.25	3.73	4.11	4.25
high (old anodes needing adjustment)		3.84	4.19	4.33	3.84	4.19	4.33
low (new anodes)		3.57	3.84	3.93	3.57	3.84	3.93
Production per day,	NaOH, ton	0.190	0.380	0.456	0.228	0.475	0.570
(Current efficiency 95%)	Cl_2, ton	0.168	0.337	0.404	0.202	0.422	0.506
	H_2, cu. ft. (S.T.P.)	1,700	3,400	4,080	2,040	4,260	5,100

Table II—Consumption of Raw Materials and Power

		Per Ton Cl_2 Gas	Per Ton NaOH	Per Ton NaOH + Cl_2
Salt		1.7 ton	1.51 ton	0.8 ton
Mercury		0.56 lb	0.5 lb.	0.26 lb.
Graphite		8.4 lb	7.5 lb.	4.0 lb.
		16-Anode Cell		
Electricity (d.c.)	5,000 amp.	2,680 kwh.	2,380 kwh.	1,260 kwh.
	10,000 amp.	2,970 kwh.	2,640 kwh.	1,400 kwh.
	12,000 amp.	3,100 kwh.	2,740 kwh.	1,460 kwh.
		20-Anode Cell		
	6,250 amp	2,680 kwh.	2,380 kwh.	1,260 kwh.
	12,500 amp	2,970 kwh.	2,640 kwh.	1,400 kwh.
	15,000 amp.	3,100 kwh.	2,740 kwh.	1,460 kwh.
Kwh. a.c. (cell motors & lights)		31	27	14

Table III—Analysis of Products

Chlorine Cell Gas		50% NaOH	
Cl_2	97 %	Na_2CO_3	0.1 %
H_2	0.5–1.0%	NaCl	0.006 %
CO_2	0.5 %	Na_2SO_4	0.0002 %
Air,	remainder	SiO_2	0.006 %
Hydrogen		Fe	0.0002 %
H_2	99.5%	Al_2O_3	0.0002 %
Air	remainder	CaO	0.001 %
		MgO	0.0001 %
		Mn	0.00002 %
		Cu	0.00003 %

Table IV—Brine Requirements

Inlet Brine	Outlet Brine
NaCl 310 g.p.l.	NaCl 260 g.p.l.

$CaSO_4$ may be up to saturation.
Fe less than 0.0001 g.p.l.
Mg less than 0.01 g.p.l.
$NaClO_3$ may be up to 10 g.p.l.

Table V—Effect of Brine Concentration

Outlet Brine Concentration	% H_2 in Cl_2	% CO_2 in Cl_2	Cell Voltage
260 g.p.l.	0.23	0.3	4.03
240 g.p.l.	0.36	0.35	3.97
220 g.p.l.	0.53	0.4	3.96
200 g.p.l.	0.73	0.47	3.97
180 g.p.l.	0.9	0.6	3.99

260-270 g.p.l. of a NaCl. Under some circumstances it is desirable to feed the brine at a lower rate. This will affect H_2 in Cl_2, anode corrosion and the cell voltage. The effect of varying the outlet brine concentration with the brine entering a cell at 40 deg. C. is given in Table V.

Common Brine Impurities

Calcium sulphate, magnesium and iron are common brine impurities. Hypochlorous acid and sodium chlorate are also present in the brine of an operating cell. Calcium can be tolerated almost to the solubility of gypsum in brine. By maintaining the sulphate slightly more than chemically equivalent to the calcium no more gypsum will dissolve from the source of solid salt and an acceptable brine is obtained. Magnesium in brine has a very decided effect on the H_2 in Cl_2 and should be kept under 0.01 g.p.l.

Iron is particularly bad if it is present as flocs of $Fe(OH)_3$ so it is important to filter brine before use. It may be maintained at a very low concentration if the pH of the brine is above 4.0.

Sulphate in brine affects the rate of anode corrosion as shown in Table VI but is controlled as discussed above.

Alkaline brine fed to the cell causes a slightly higher rate of anode corrosion than neutral or acidic brine. Alkaline brine or alkali released in the electrolyzer by H_2 discharge results in the formation of hypochlorous acid in the cell. Hypochlorous acid is undesirable as it forms chlorate and adds to the amount of hydrochloric acid required in the dechlorination step of brine purification.

Chlorate is formed in the cell as indicated above but is also reduced by the sodium amalgam. In brine systems using dechlorination the chlorate level runs at 0.1-0.2 g.p.l. At high concentrations it has a slight effect on anode corrosion.

There are three main sources of salt for alkali-chlorine electrolysis: (1) brine from wells, (2) rock salt or (3) evaporated salt. These materials can be handled in a number of ways to give a brine satisfactory for mercury cell electrolysis.

Evaporated salt can be obtained by conventional methods of evaporator operation in a pure form suitable for mercury cell electrolysis. The depleted brine coming from the cells would be resaturated with the salt followed by filtration and possibly by the adjustment of pH.

Table VI—Effect of Sulphate on Anode Corrosion

Sulphate as Na_2SO_4	Graphite Loss per Ton NaOH Produced
0.0 g.p.l.	4.2 lb.
3.0 g.p.l.	5.1 lb.
6.0 g.p.l.	6.0 lb.
9.0 g.p.l.	6.9 lb.
12.0 g.p.l.	7.8 lb.
15.0 g.p.l.	8.6 lb.

Where rock salt of sufficient purity can be obtained at a low enough price an operable brine can be obtained by discarding sufficient brine to maintain the impurities at the desired level. Under such circumstances the depleted brine from the cells would be resaturated with the rock salt, then settled and filtered to remove insoluble impurities. A portion of the depleted brine from the cell would be continuously or periodically discarded to the sewer with the addition of fresh brine or water.

Third Process

The object of a third process is to remove all impurities except calcium sulphate. The unit steps in this process would be to dechlorinate the depleted brine from the cells, resaturate, make alkaline, flocculate, settle, filter, neutralize and return the brine solution to the cells.

The brine coming from the cell contains dissolved chlorine and hypochlorous acid in varying concentrations which must be removed before the brine is made alkaline. It is first necessary to add hydrochloric acid equivalent to the hypochlorous acid and chlorate present thus forming water and chlorine. The dissolved chlorine plus that formed from the chlorate and hypochlorous acid can be removed by boiling at atmospheric pressure, by flash evaporation at reduced pressure, or by blowing air through the brine. The most economical method of dechlorination for larger plants is probably to flash evaporate the acidified brine at approximately 20 in. of mercury vacuum and then blow air through the brine to remove the final traces of dissolved chlorine. For smaller installations it is probably more economical to remove the chlorine by blowing air through the brine. This latter method has the disadvantage that a relatively large amount of dilute chlorine gas must be disposed of whereas the former method yields a high concentration of chlorine gas which may be returned to the system. After dechlorination, the brine should contain less than 0.01 g.p.l. of chlorine.

After resaturation the brine is made alkaline with caustic soda to an excess of approximately 0.001 N alkali. This will precipitate $Mg(OH)_2$ and $Fe(OH)_3$. In order to increase the size of the flocs the brine is stirred gently for a period of time and is then passed through a settler where the floc is settled out. At this same point, graphite particles and inert materials from the rock salt are removed. In order to insure pure brine at all times, it is advisable to pump the brine through a polishing filter. Occasional additions of Na_2CO_3 may be necessary to keep the calcium slightly less than chemically equivalent to the sulphate.

The main difference between a fourth method, complete purification of rock salt, and the third process is that the calcium sulphate is removed by the use of barium carbonate. The steps in this process are dechlorination, resaturation, addition of barium carbonate and caustic soda, flocculation, settling, filtration.

At a location where brine from wells is available, it is economical to pass the brine once to the cells and then discard the effluent. In this method of operation the brine rate to the cells is reduced until approximately one-third of the salt content of the brine is electrolyzed out. Cell operating conditions are not as good under these circumstances but the process is operable. In order to remove insoluble matter from suspension in the brine, the brine would be filtered before going to the cells. In certain locations it would be necessary to dechlorinate the brine before discarding it to eliminate offense from dissolved chlorine.

Where a chlorine plant is located near brine wells it would be economical to return the depleted brine from the cells after dechlorination to the wells for resaturation so that the process would be in effect similar to the third and fourth methods described above. In this case the brine would have to be more carefully dechlorinated than in the other methods or the expensive brine well piping would be corroded away.

In yet another process the depleted brine from the cells is dechlorinated and then brought up to saturation in a vacuum flash evaporator. Salt, equivalent to that which is electrolyzed, is added as saturated brine and then the resulting brine is given a partial or complete purification similar to either the third or fourth method.

Viscosity Measurement—Oil Industry's Tool

D. J. POMPEO

Shell Development Co., Emeryville, Calif.

IN REFINING products derived from petroleum one of the important properties requiring close control is viscosity. Specifically this applies to such liquids as lubricating oils, fuel oils, diesel oils, jet fuels, hydraulic oils, certain types of greases, and various types of cut back asphalts used for road construction. Too, in certain operations connected with production of petroleum, viscosity measurement is a very significant factor.

Viscosity of a fluid is that property which is due to internal resistance offered to the motion of any portion of that fluid with a velocity different from that of a contiguous portion. The absolute dynamic viscosity of a fluid is the tangential force on unit area of either of two parallel planes at unit distance apart when the space between the planes is filled with the fluid in question and one of the planes moves with unit velocity in its own plane relative to that of the other.

Another important property of a lubricating oil is the viscosity index. This is an empirical number (ASTM Method D567), indicating the effect of change in temperature on the viscosity. A low viscosity index signifies a relatively large change in viscosity with temperature and vice versa.

In a typical refinery control laboratory, approximately 300 determinations of viscosity are made per day (24 hr.) in order to control quality of the various products and to see that specifications are met. About 90 percent of the determinations are made on lubricating oils and the remaining 10 percent on asphalts, fuel oils and on diesel oils to a lesser degree. Kinematic viscosities are usually determined in the laboratory on lubricating oils and dark oils at temperatures of 100, 130 and 210 deg. F. using the capillary type instruments; for determining the viscosity of asphaltic type materials where extreme accuracy is not too important, the Saybolt type of instrument is used at temperatures of 77, 122, 140 and 180 deg. F.

Accurate temperature control is an important factor in the measurement of viscosity regardless of the type of instrument used—whether capillary or Saybolt. The effect of temperature on viscosities of various types of oils is illustrated in the data of the accompanying table (Cannon and Heidrich, *Petroleum Refiner*, Vol. 26, p. 123, Feb. 1947.)

Effect of Temperature on Viscosity

	Average Percent Change in Viscosity Per Deg. F. Change in Temperature	
Oil	80-100 deg. F.	180-210 deg. F.
A	3.4	1.38
B	4.5	1.62
C	5.4	2.1
D	8.2	2.8

The accuracy obtainable by the kinematic viscosimeter, according to the ASTM Method D445, is of the order of 0.2 percent; but the temperature should be controlled to at least 0.05 deg. F. to meet the requirements of this test.

Crude oil as obtained from a well contains the lubricating oil which has to be separated and refined to be of use; in a typical refinery distilling of 15,000 bbl. per day as many as five fractions are obtained. A side stream from the various cuts is diverted to a control house where an operator periodically checks the viscosity with a Saybolt instrument. At this point the measurement of viscosity aids the operator in properly controlling the column. The control laboratory rechecks the samples from the storage tanks before the oil goes to the next stage of the refining process.

Lubricating oil fractions thus obtained contain undesirable components that produce an oil having a wide variation in viscosity with temperature variations. One extensively used method for removing these undesirable components is solvent refining, with furfural as the extraction agent (Skelton, *Oil and Gas Journal*, p. 137, Feb. 22, 1947). Since the plant is operated to produce an oil of a certain viscosity index the extraction process is controlled by sampling and measuring the viscosity at two temperatures (100 and 210 deg. F.) to calculate the viscosity index. It should be noted that a measurement of refractive index of the treated oil can be correlated to the viscosity index. While this is an indirect means for determining viscosity index, this measurement has a distinct advantage for plant control. The test can be made with an Abbe refractometer by the operator and if necessary corrective measures applied without the need of obtaining laboratory results, a time consuming procedure.

In removing the wax contained in solvent-refined oil from paraffinic crudes, the viscosity of the oil (and its pour point) is measured as a means of controlling the process.

A number of refinery operations require the blending of various lubricating stocks to viscosity and viscosity index specifications. To ensure proper quality the control laboratory must determine the viscosity or viscosity index of the blends. In these operations considerable thought is being given to automatic blending devices and means for continuous determination of viscosity. This will reduce the need for expensive storage capacity, aid in better control of the process and decrease labor costs of analysis.

Similarly it is necessary to blend fuel oil and road oils. Blending by means of gravity measurements is not a satisfactory means of control because the material's viscosity is a limiting factor in meeting specifications.

Automatic Control

At the present time, except in a few isolated cases, direct indicating or recording viscosimeter instruments which provide automatic control of processes and which can be satisfactorily used in refinery work are rather uncommon. The places where automatic instruments would be useful to the control of process variables are briefly summarized as follows:

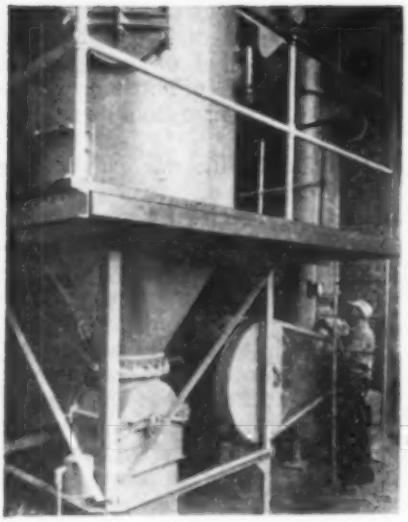
1. At the control house where the lubricating oil fractions are obtained. An accuracy of 1 to 2 percent in a determination is probably sufficient for this purpose because the oil requires further processing.

2. At solvent refining and dewaxing plants. Here, the measurement of viscosity index is important. Indirect methods, such as continuous measurement of refractive index, may be used to obtain a measure of viscosity index.

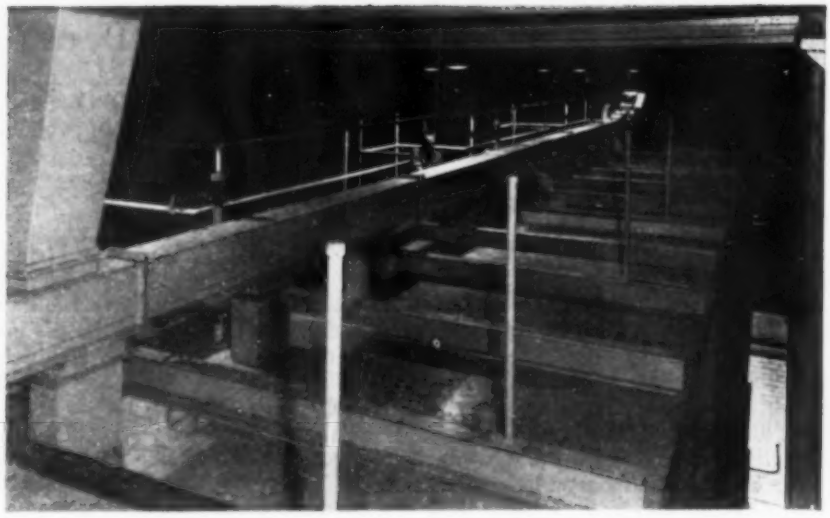
3. At the compound house where the lubricating oil is blended. Especially would this be important if continuous blending operations were developed because viscosity measurement would be required soon after the mixing took place.

4. At pump houses where road oils are blended and asphalts are pumped to tank cars, trucks or barges.

Abstract of a paper delivered before the second national conference of the Instrument Society of America, Chicago, Ill., Sept. 8-12, 1947.



1 CORN SUGAR is unloaded with this pneumatic conveyor system then . . . .



2 DUSTPROOF CONVEYOR distributes the sugar to various sections of three storage bins containing a total of 1,000,000 lb.

Sorbitol From Corn Sugar By Catalytic Reduction

RICHARD W. PORTER
Assistant Editor, *Chemical Engineering*

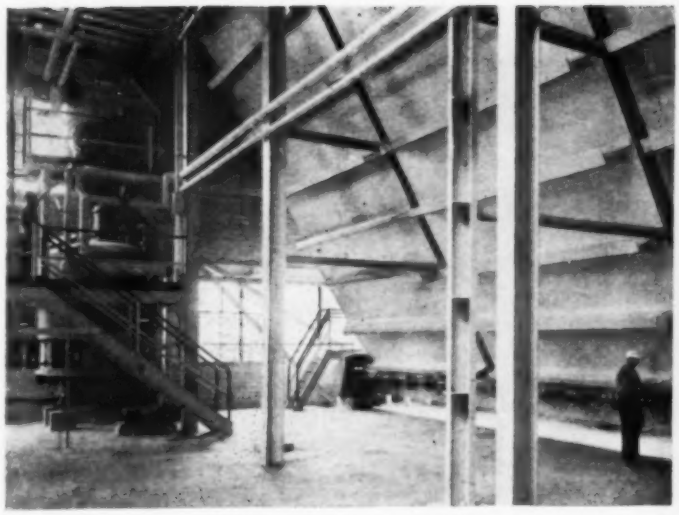
ATLAS POWDER CO.'S CHEMICAL ENGINEERS PERFECT PROCESS FOR TURNING OUT A C.P. COMPOUND IN TANK CAR QUANTITIES

In 1937, the Atlas Powder Co. announced the commercial availability of sorbitol. Manufactured by the electrolytic reduction of corn sugar (dextro-glucose) this was one of the first successful methods for the direct chemical utilization of sugar (see *Chem. & Met.*, Oct. 1937). Since 1937, production has expanded several fold, first by adding new electrolytic batteries, then by installing a high pressure catalytic hydrogenating process. Now after extensive laboratory and pilot plant studies, a new $3,000,000 catalytic unit has been put into operation at Atlas Point, Del. Chemically, the reaction of corn sugar with hydrogen to yield sorbitol is the same by either process. But the high pressure catalytic process accomplishes the conversion in a matter of minutes, whereas electrolytic reduction requires many hours. New techniques and improved purification methods have resulted in a product quality seldom attained in large scale production.

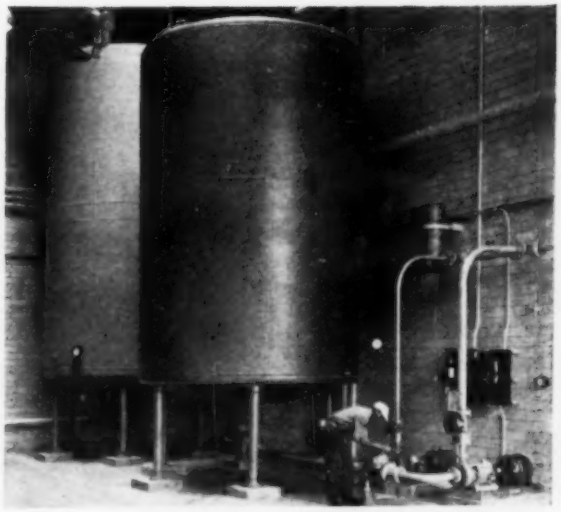
Prior to 1937, sorbitol was little more than a laboratory curiosity but its versatility both chemically and physically brought a rapidly widening field of applications. Sorbitol is a hexahydric alcohol and has many characteristics similar to those of ethylene glycol, glycerine, pentaerythritol and other members of this homologous series of polyhydric alcohols. Its six hydroxyl groups and the asymetric character of its molecule make possible many derivatives. Sorbitrol is used as a raw material in the manufacture of synthetic vitamin C, synthetic resins, plasticizers, drying oils, and in surface active agents such as emulsifiers. It is also used widely as a humectant, softener and blending agent for tobacco, paper, cosmetics and other similar products.

During the war, virtually all the output of sorbitol and its derivatives made at Atlas Powder (surface active agents, emulsifiers, etc.) went for military or essential civilian purposes. Production capacity was nearly tripled during this period to meet war requirements but was still not enough to satisfy the demand. Even at the war's end, the civilian demand far exceeded production capacity. However, by that time, the new catalytic process had been perfected and thoroughly tested on a pilot plant and semi-works scale so that it was possible to go ahead with the necessary expansion.

Three buildings house the new sorbitol plant. All operations except the manufacture of hydrogen and the actual high pressure hydrogenation reaction take place in the main building which also provides raw material and finished product storage together with the control laboratory and operational offices. All equipment is painted an



3 PROCESS begins with taking sugar from storage and dissolving in 3,000-gal. weigh tank on the left; sirup is held in . . . .



4 STORAGE TANKS from which the solution is continuously drawn to be mixed with catalyst . . . .

NEW PROCESS FOR MAKING SORBITOL

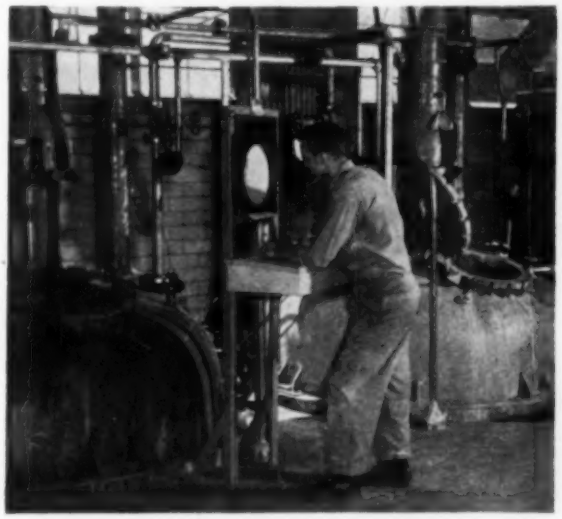
DISSOLVE corn sugar in water and mix with nickel-clay catalyst to form reaction slurry

HYDROGENATE under high pressure to form sorbitol in a continuously operated reactor

FILTER spent catalyst from sorbitol solution; catalyst is reprocessed and reused

PURIFY sorbitol solution by deionization then decolorize with activated carbon

CONCENTRATE by evaporation; final strength is adjusted by weighed addition of water



5 CATALYST is processed in these reactors; first step is formation of nickel nitrate, meanwhile . . . .

olive shade to provide a pleasing appearance and a minimum of eye fatigue. Pipelines and conduit are color coded for identification and safety. Equipment is arranged for maximum efficiency and convenience, thus requiring a minimum of supervision.

Both hydrogen manufacture and the hydrogenation process take place in separate buildings some distance from each other and from the main plant. By this means, the area exposed to hydrogen is restricted. Adjacent to the main building is a new steam plant that serves the entire plant as well as the new sorbitol unit.

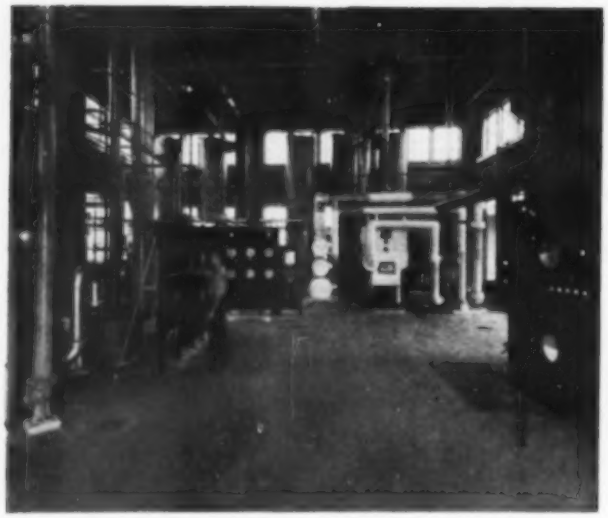
Raw Materials

Principal raw materials for the process are corn sugar and hydrogen. The highest commercial grade of refined corn sugar is used in the production of sorbitol, since any impurities present in the raw material tend to interfere with the quality of the final product. Hydrogen is manufactured from coke by the steam-iron process and stored in gas holders prior to use. Supported nickel catalyst is also prepared at the plant in a series of process steps involving the use of nitric acid, caustic soda, nickel and clay. Organic ion exchange materials used for demineralizing the sorbitol solution, require sulphuric acid and caustic soda for regeneration. Darco activated carbon, manufactured by a subsidiary of Atlas, is employed in the final purifying and decolorizing steps.

Corn sugar is received in bulk in covered hopper bottom cars and is unloaded directly into storage bins by means of pneumatic conveyor system. Cars are located on a siding adjacent to plant storage. From each hopper the sugar drops into a twin nozzle car unloading unit and is pneumatically elevated to a cyclone separator above the 70 ft. high storage bins. From the separator the sugar drops into a dust tight conveyor and is delivered to any one of the three steel storage bins having a combined capacity of 1,000,000 lb. of sugar.

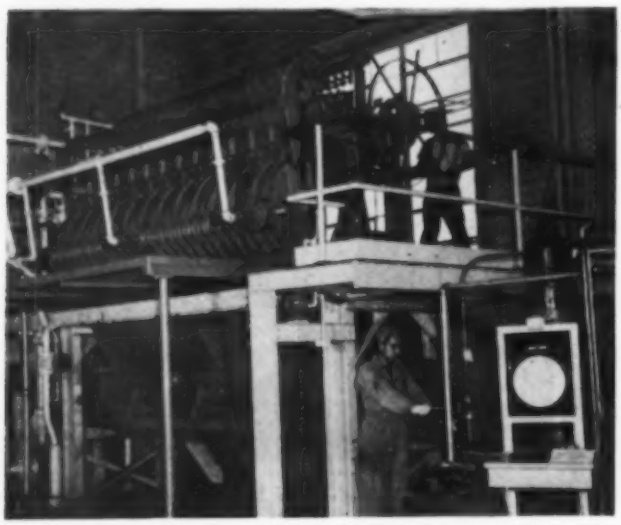
This is the first time that refined corn sugar has ever been handled in bulk. Atlas is the largest single industrial consumer of this commodity and is first to institute this efficient time and labor-saving system. With a minimum of labor and supervision, it is possible to unload a full carload of sugar in only a few hours.

Converting corn sugar to sorbitol takes place in five main steps, namely (1) preparation of feed slurry by dissolving sugar in water and mixing with special catalyst, (2) continuous high pressure catalytic reduction of glucose to sorbitol in a specially designed reactor, (3) separation of spent catalyst

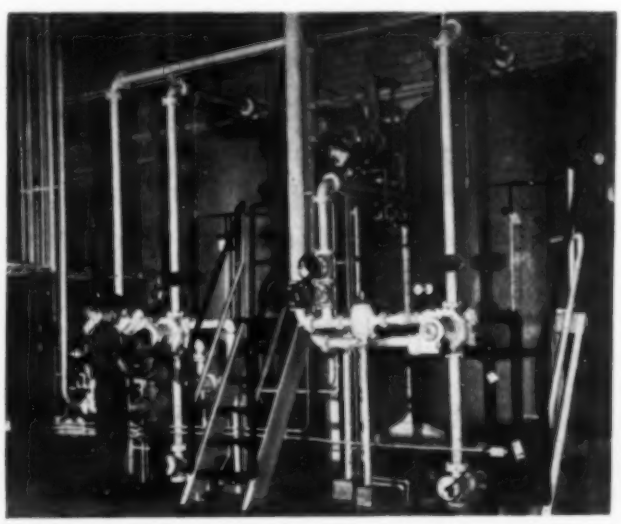


6 HYDROGEN is manufactured by the steam-iron process and is purified in scrubbing columns, then . . . .

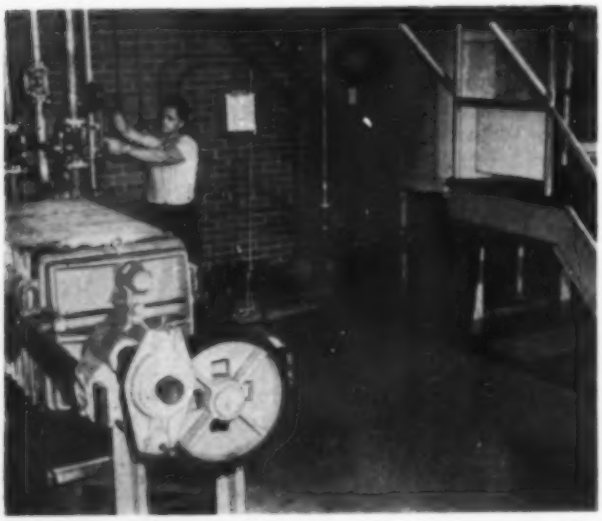
7 SORBITOL is made in this building by bubbling hydrogen into sugar-catalyst slurry at high pressure . . . .



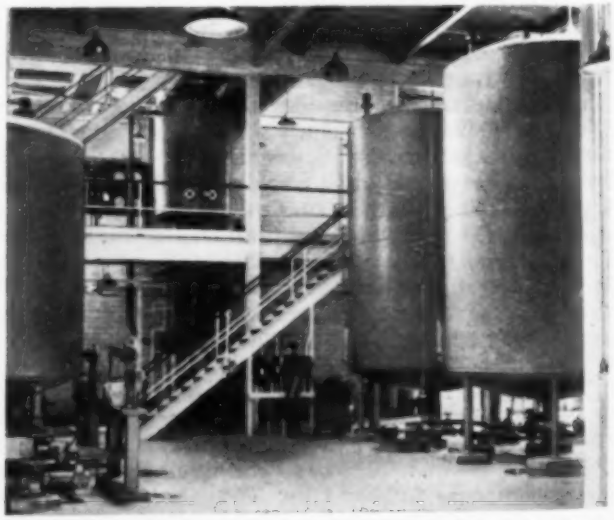
8 FILTER separates sorbitol from spent catalyst which is recovered while the clear solution passes to a . . . .



9 DEIONIZATION unit where all ionizable impurities are removed by cation and anion exchangers; further . . .



10 PURIFICATION takes place by decolorizing with activated carbon which is filtered off; finally . . . .



11 EVAPORATION (center) is followed by blending with water in weigh tanks (left) to obtain 70 percent sorbitol

from clear sorbitol solution by filtration, (4) purification by deionization followed by decolorization with activated carbon, (5) concentration by evaporating the purified solution followed by adjusting the final concentration to exactly 70 percent sorbitol through addition of demineralized water in agitated weigh tanks.

The Process

First step in the process is to make up a sugar-water sirup of the desired concentration for the process. Sugar from storage is dropped by gravity to the inclosed conveyor through manually operated sliding gates and is then charged into a 3,000-gal. agitated weigh tank. Warm water is first weighed into the dissolving tank and the exact amount of sugar added. Weight of each ingredient is automatically printed on a ticket so that an accurate record is kept of the sugar usage. Concentration of the solution is limited by the solubility of sugar at normal temperatures. If the solution is too concentrated, sugar will crystallize out in pipelines and storage tanks. Dissolving rate is improved by using warm water and by further heating.

From the dissolver, sugar solution is pumped to a 12,000-gal. tank which provides storage capacity to feed the continuous reactor. Sugar solution is pumped intermittently to either one of two agitated weigh tanks where the reaction slurry of sugar solution and catalyst is prepared. Catalyst is discharged directly into a weighed quantity of sugar solution so it is necessary to have two weigh tanks to permit continuous operation. This operation is controlled by an automatic scale cutoff which manipulates the solution valves and diverts the fresh, hot catalyst from one weigh tank to the other. Resultant slurry is pumped to a small storage or surge tank in the autoclave building.

Hydrogen is generated by passing steam over iron, and the iron oxide thus formed is reduced with blue gas made from coke and steam. Crude hydrogen is scrubbed with caustic soda to remove carbon dioxide and the carbon monoxide present is oxidized by steam over a water gas shift catalyst to form more hydrogen and carbon dioxide. The carbon dioxide so formed is scrubbed out with caustic soda and the main gas stream is passed over a catalyst to reduce residual traces of carbon monoxide to methane, a harmless impurity. The hydrogen is then stored in gas holders at low pressure.

High pressure catalytic reduction of the corn sugar solution takes place in a separate building about 100 yards from the main plant. The slurry of sugar solution and catalyst is pumped from the surge tank into the continuous reactor with a variable speed triplex pump at a pressure on the order of 125 atm. Hydrogen from the low pressure gas holder is compressed and stored at about 175 atm. in a large cylinder outside the autoclave building. From here it is bubbled into the reactor with the reaction slurry. The reactor is comprised of several vertical tubes. Reacted slurry and excess hydrogen discharge from the reactor to a receiver where hydrogen is separated from the slurry. Recovered hydrogen is compressed and recycled while the slurry of sorbitol and spent catalyst is pumped to a prefilter holding tank in the main building.

All essential equipment for this continuous process is provided in duplicate to assure uninterrupted operation. Protection against hydrogen leakage is provided by hydrogen analyzers that draw samples of air from various locations in the building and sound an alarm in case the hydrogen concentration rises too high.

Sorbitol solution is separated from spent catalyst in a pressure leaf filter. Catalyst is processed and reused while the clear filtrate of sorbitol-water solution passes to intermediate storage. The crude sorbitol solution contains impurities which must be removed. Ionizable salts are removed in a two-stage ion-exchange unit using organic ion exchangers. Metallic cations are removed in the first stage and anions are absorbed in the second stage. Effluent from the demineralizer unit is free of all ionizable impurities.

Purification

The ion exchange unit serves two purposes; namely, purifying the sorbitol solution and demineralizing water. Demineralized water is used for diluting the final sorbitol solution to the 70 percent concentration at which it is sold and is used also in washing the exchanger bed before and after regeneration. Treated water is stored for use in a 12,000 gal. storage tank.

Since the sorbitol solution is subsequently concentrated by evaporation it is necessary to prevent undue dilution. When the exchanger cells go on-stream the voids between the exchanger particles of the bed are filled with water. Part of this is displaced by a piston-like action and contains no sorbitol, but the remainder forms a dilute sorbitol solution which is returned to storage. This is known as "sweetening-on" and the dilute sweet water so obtained is used at the beginning of the "sweetening-off" at the end of the cycle (see "Report on Ion Exchange" *Chem. Eng.*, July 1947). Sulphuric acid and caustic soda are used to regenerate the ion exchange bed.

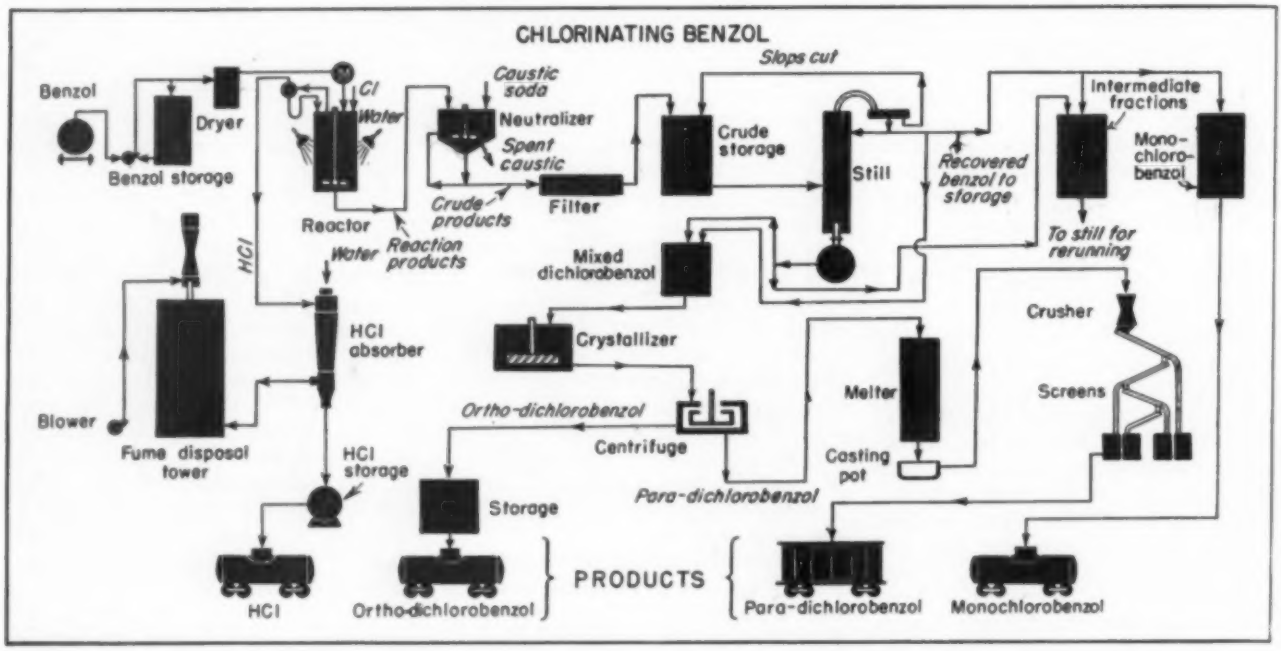
Prior to demineralization, all equipment in the sorbitol process is constructed of ordinary steel since there is negligible corrosion and contamination is slight and of no consequence. The ion exchange unit is made of rubber lined steel to resist corrosion and contamination. All equipment after this step is made of stainless or stainless-clad steel to insure maximum purity of the product.

After demineralization, the solution is pumped to a large agitated tank where it is mixed with a prepared slurry of Darco activated carbon. Organic impurities and color bodies are adsorbed by the carbon during the treatment, after which the slurry is filtered on a plate and frame filter. Spent carbon containing adsorbed impurities is dumped direct to the sewer and the purified water white sorbitol solution is pumped to storage tanks prior to being concentrated by evaporation.

Evaporation

A stainless steel single effect continuous evaporator is employed to concentrate the solution from below 50 percent sorbitol to slightly higher than 70 percent. Operating at about 27.5 in. Hg vacuum and nearly 200 deg. F., discharge is controlled automatically by continuous specific gravity meters. The evaporator discharges continuously into either one of two 4,000-gal. agitated blending tanks. Here the final quality is checked and the concentration is accurately adjusted by weight to 70 percent sorbitol by addition of demineralized water. The weigh tank scales used for adjusting the final concentration print the weight on a ticket to give a record.

Pure 70 percent sorbitol solution ready for shipping is stored in four stainless steel tanks, totaling 100,000 gal. capacity from which it is drawn to fill 50-gal. drums or tank cars. Drums are filled with a given weight of sorbitol solution. Conveyor scales are used first to obtain tare weight and then to measure total weight. An automatic scale cutoff actuates a quick-acting valve in the sorbitol filling line where the desired weight in the drum is attained. Tank cars are filled by volume measurement from the storage tank and are then weighed on track scales.



BENZOL—How It's

PROCESS EMPLOYED IN CONVERTED WAR PLANT TO PRODUCE MONO- AND DICHLOROBENZOLS

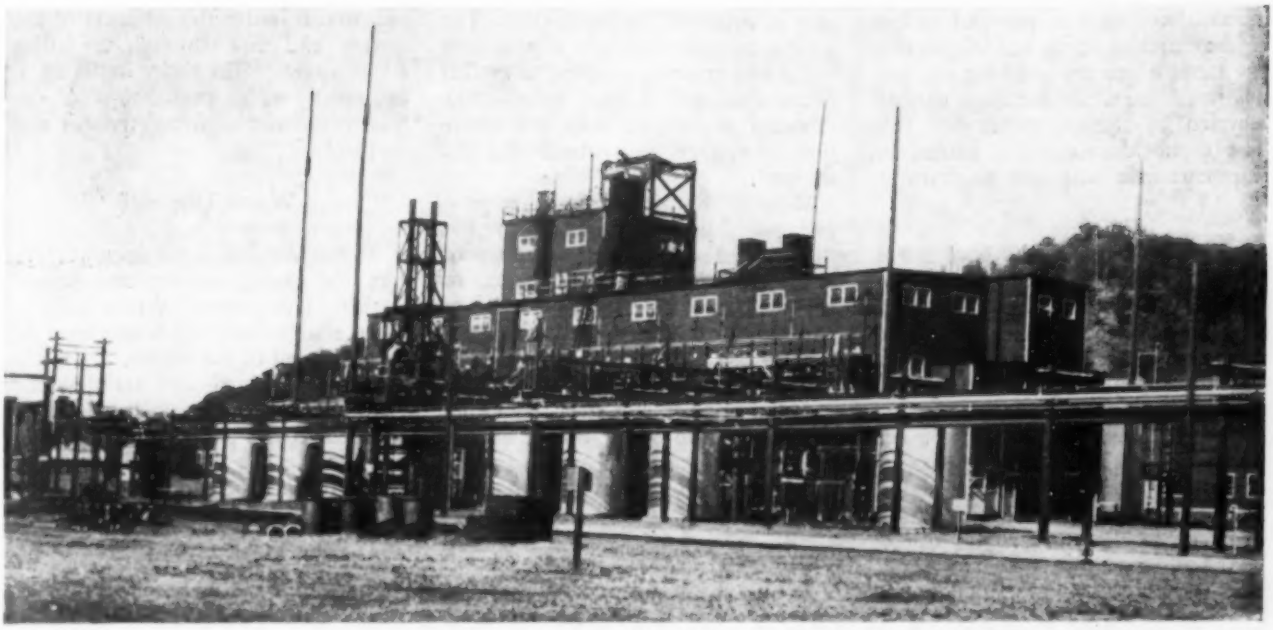
CHLORINATED hydrocarbons, increasingly in the news of late, came dramatically into their own during World War II. Among the many chlorinated hydrocarbons now in demand are the mono- and dichlorobenzols. Used in the production of phenol, aniline, dyestuffs and other compounds, monochlorobenzol, which is also employed as a solvent for ethyl cellulose and synthetic resins, has increased steadily in production. In 1941 its production stood at 128,854,000 lb. By 1946 this figure had more than doubled, reaching 268,688,000 lb. Monochlorobenzol production in the first five months of 1947 was 127,656,293 lb. The ortho-dichlorobenzol, used as a solvent and fumigant, as well as for other purposes, rose from a production of 7,755,000 lb. in 1941 to a figure of 11,843,000 lb. in 1945. Simultaneously the para-dichlorobenzol, used in deodorant blocks, insecticidal preparations and in organic synthesis, jumped from an output of 18,468,000 lb. in 1941 to 26,545,000 lb. in 1945.

Former CWS Plant

The potential market for these promising organic chemicals was recognized by the management of Glyco Products Co., Inc., of Brooklyn, N. Y., which decided to enter this expanding field. Pilot plant development completed, the decision to start commercial production was made. Glyco announced its lease of the Marshall plant, Chemical Warfare installation during World War II which turned out a big production of chlorinated aliphatic solvents and hexachlorethane. On the Ohio River, this plant is at Natrium, W. Va., about 30 miles below Wheeling. Glyco plans to produce other chemicals here and to transfer eventually all of its Brooklyn operations to this site.

Fourteen brick and frame constructed processing buildings form the operating nucleus of Glyco's new West Virginia plant. In addition there are administrative offices, research and control laboratories, photographic and blueprinting departments, machine

Key raw materials in organic synthesis, the chlorinated benzols are now in sharply rising demand as aromatic intermediates, solvents, insecticides, fumigants and deodorants. Discharged veteran of World War II, the former CWS plant, strategically situated on the Ohio River at Natrium, W. Va., now has a peacetime job turning out mono- and dichlorobenzols in order to meet this stepped-up demand.



Leased by Glyco Products Co., Inc., this former CWS plant at Natrium, W. Va., is now producing chlorinated benzols

Chlorinated

JAMES A. LEE
Managing Editor, *Chemical Engineering*

and carpenter shops, warehouses, garage, hospital and recreational facilities. Equipment in all of these buildings is of the finest quality. Since taking over the Marshall plant from the Chemical Corps, Glyco's engineers have grappled with the job of converting it to new uses, by no means a simple undertaking. They have done a splendid job.

Strategically Situated

Spread over 84 acres, the plant enjoys accessibility to transportation and proximity to raw materials. A half mile of Baltimore & Ohio Railroad sidings serves the plant. Barge landing facilities are being planned. Natural gas lines cross the property and there are underlying deposits of salt and coal. Adjacent is the electrolytic chlorine and caustic plant of the Columbia Chemical Division of Pittsburgh Plate Glass Co., source of chemical raw materials.

Raw materials in present use at this Glyco plant are benzol, caustic soda and chlorine. The benzol arrives in tank cars from suppliers in the area. It is pumped into 10,000-gal., above-ground, steel storage tanks. Caustic likewise comes in tank cars. Two chlorine pipelines, each one-half mile long, connect the plant with the electrolytic chlorine-caustic plant of Columbia Chemical Division, its raw materials supplier. One of the lines, the 10-in. gaseous chlorine line, operates under a 10-lb. pressure. The other line, for liquid chlorine, is a 4-in. line. The chlorine is metered as it leaves Columbia's property. Process water is supplied by a Ranney well.

Heart of the process is the benzol chlorination, carried out at atmospheric pressure and moderate temperature. Benzol and chlorine are metered and brought together in the presence of molybdenum chloride in the chlorinators. These chlorinators are tall, cylindrical, cast iron vessels, agitated and equipped with condensers. A film of falling water on the outside helps control the reaction. Each chlorinator has a chlorine manometer, an orifice meter, a temperature recorder and a draft gage. Completion of the chlorination is determined by the specific gravity of the resulting mixture.

Exit gases consist of unreacted benzol, hydrochloric acid, monochlorobenzol, ortho- and para-dichlorobenzol, a small volume of meta-dichlorobenzol and other reactants. Hydrochloric is recovered by means of a Fansteel absorber.

The reaction products are pumped by Hastelloy pumps from the chlorinators to the neutralizers, conically shaped, agitated tanks. Here they are treated with caustic soda. The spent caustic layer goes to the sewer, and the crude products are filtered and pumped to storage in 10,000-gal. and 30,000-gal. steel tanks.

Distillation

Separation of unreacted benzol, monochlorobenzol and dichlorobenzol from each other is achieved by distillation in Raschig ring-packed columns. Monochlorobenzol and unreacted benzol are taken off separately, the benzol being returned to storage for further use. Distillation can be carried out in any one of four continuous and semi-continuous columns. One column is 48 in. in diameter, two are 40 in. and a fourth is 30 in. They range in height from 60 ft. to 35 ft. Controls on the columns include: pressure controllers, recorder for top, bottom and feed plate temperatures, differential column pressure, still pot liquid level, and condenser.

Leaving the distillation column,

monochlorobenzol is pumped to one of the series of seven 30,000-gal. storage tanks which are used for the various fractions, while the slops cuts are recycled to storage before the still. The monochlorobenzol is loaded for shipment into tank cars or drums.

Refrigeration

Refrigeration is employed to separate the ortho-dichlorobenzol from the para-dichlorobenzol. The mixture of dichlorobenzols is pumped into a refrigerated tank where the para-dichlorobenzol crystallizes. The mass is conveyed by a slurry pump to a centrifuge. From here, after the para and the ortho are separated, the crystalline para is conveyed to the melter. The para is melted, cast into a pan, conveyed to a crusher, screened to market size and shipped. Liquid ortho-dichlorobenzol is pumped from the centrifuge to storage, put into drums and shipped.

General ventilation for this processing building is provided by two brick stacks equipped with dampers on each operating floor and with fans on each of their tops. A second speed on the fans is used whenever the gases become noticeable.

The fume disposal tower, constructed of brick and steel framework, is packed with spiral rings. Suction is provided by a Haveg venturi. Gases enter at the top, pass down between two towers, enter the bottoms of the towers and rise through a falling water spray. The entire building is equipped with explosion-proof or totally inclosed lighting fixtures and motors.

Waste Disposal

The plant has a triple sewer system for storm, sanitary and process wastes. The process system leads to three sludge beds which are used for final disposal of the wastes.

New glass-lined and stainless-steel chemical process equipment has been shipped to the plant site and will be activated in the future. A new boiler house has just been completed.

Where There's A Way There's A Well

SEPARATED by 8,000 miles and 2,000 years, a farm in Persia in 800 B.C. and the new Glyco plant at Natrium, W. Va., are, nonetheless, linked by the manner in which they get their water. Tired of digging new wells whenever one ran dry, the Persian farmers began to use collection galleries to increase the supply of water available to their vertical wells. Using this same idea but vastly refined, a California petroleum engineer, Leo Ranney, developed what is known as the Ranney water collector. And it is this type of well that the Glyco plant uses.

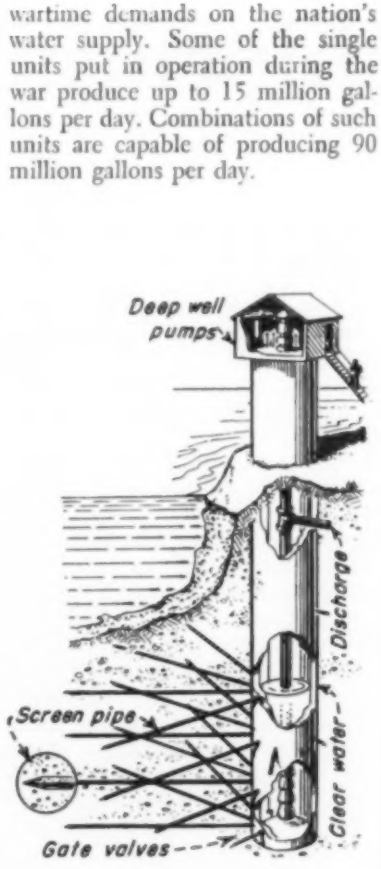
While every Ranney well is tailored to the location and need, the well at Natrium is typical of such installations. Here, the reinforced concrete caisson, 13 ft. I.D. and 72 ft. over-all length, extends 50 ft. below the grade. Topping the caisson, a 24 ft. square building houses three 5,000 gal. per min. deep well pumps that lift the water from the bottom of the caisson where it is collected and send it to the plant. At four different levels, pointed, perforated steel pipes (10 in. diam.) radiate through portholes in the caisson into the water-bearing ground. There are 14 of these collector pipes, seven under the river, the others under the land, extending in length from 33 to 241 ft.

These collector pipes constitute the most distinctive part of the Ranney well. During installation, a special digging head, connected to the interior of the caisson by a sand discharge pipe, excavates the fine material in the ground, to leave a gravel structure around the collector pipe. As the head is driven out, sections of perforated screen pipe are projected after it around the sand discharge pipe, and welded together. The sand discharge pipe is subsequently removed and the screen collector pipe closed off at the porthole opening in the caisson with a gate valve.

Exposes Large Area

There results from this procedure the exposure of a large area of water-bearing ground to the horizontal screen pipes; and a permeable gravel pack around each, so that the low velocity inflow of water is not apt to entrain solid matter to clog the perforations or be carried into the well. However, with each radial pipe easily accessible and independently controlled, a backwashing feature is provided to free the screen sections from any plugging which might occur.

First used to increase London's water supply during the severe 1934 drought, the Ranney method achieved its present widespread industrial application as a result of wartime demands on the nation's water supply. Some of the single units put in operation during the war produce up to 15 million gallons per day. Combinations of such units are capable of producing 90 million gallons per day.



RANNEY WELL is water supply source which makes use of underground collector pipes

How "N" System Simplifies Piping Cost Estimation

R. A. DICKSON

Engineer, Caldwell, N. J.

DAVE WHITELY IS A PRODUCT OF THE AUTHOR'S IMAGINATION, BUT THERE IS NOTHING IMAGINARY ABOUT THE UTILITY OF HIS SYSTEM

PROCESS EQUIPMENT COSTS

Piping represents a high proportion of equipment cost in most types of process plant. Further than that, its estimation is usually quite laborious. "Dave Whitely's" N System is based on the simple fact that the cost of a string of pipe of any size bears a predictable relation to the cost of the same string in another size. Hence only the cost of the "reference" string in each kind of pipe need be kept up to date.

A GROUP of men around a conference table pored over a map that looked as if it had come from a travel bureau. Suddenly, like a flock of birds preparing to take off, they sat back and looked expectantly at Dave Whitely standing by for instructions.

"There's the route of the gas line, Dave," the chief engineer said peremptorily, indicating a heavy black line meandering across the map. "All of 11,000 ft. of pipe. Give us the cost in 4, 6, 8 and 10 in. sizes." He paused, then added, "Tonight! Have the gang work overtime."

Dave noted that the time was 3:15. "The overtime won't be necessary—"

The Chief interrupted, charging the air with a fizzing and sputtering like the flame in a fuse approaching its explosive, then wound up with the ultimatum: "—and I don't want any guestimates!"

"We'll be within 10 percent, all right." Dave offered confidently as he started for his own office.

He knew that his estimating section was well equipped to take care of the assignment that had just been handed to him. Worked out in the research laboratory of his own office, and well proven on pilot plant sized jobs, his method of estimating piping costs was now ready to give the accuracy and speed needed for the big project laid out on the map before him.

It was based on the simple fact that if the cost of installing a string of pipe of a size taken as a standard is X dollars, and the cost of the same string in any other size is Y dollars, then $Y/X = N$, and N plotted against nominal size gives a smooth curve.

To show curves for all different kinds of pipe used in the chemical industry—the steel, copper, nickel, iron and other alloys, designed for pressure all the way from 125 to 2,500 lb., and for temperatures from −50 to +1,100 deg. F.—would take a large sized book. What Dave Whitely did, anyone can do after being shown how.

A Few Definitions

1. A "string" of pipe is made up of a length—any length—of pipe, plus a number of fittings and valves—for example, 750 ft. of pipe, eight fittings and three valves.

2. The reference size is that size whose factor is 1.0 on the curve. The reference size is arbitrarily selected.

3. The factor N is the ratio of the cost of a string of pipe of any size to the cost of the same string in the reference size.

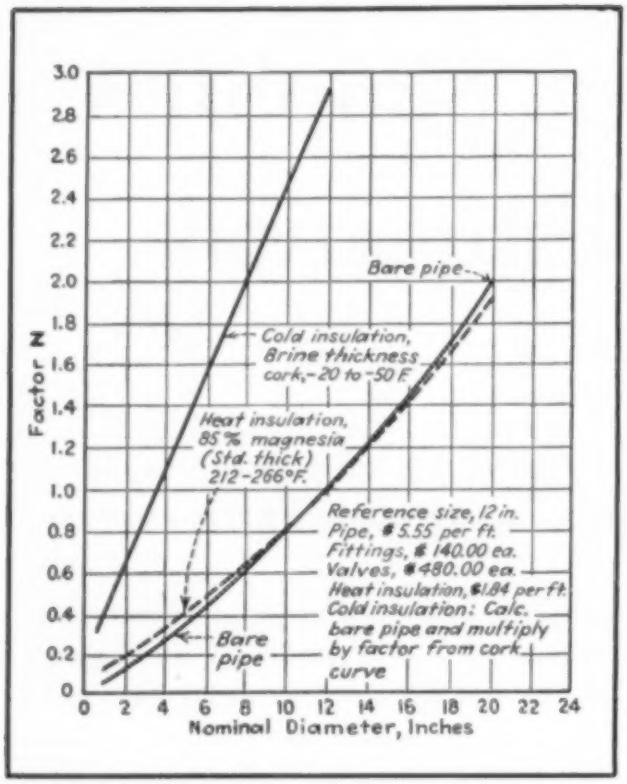
4. For insulated lines, the reference string is calculated with insulation added and the N factor used as in bare strings (except for the cork insulation in Fig. 1, which is handled as noted on the chart).

5. Manifolds are handled as strings.

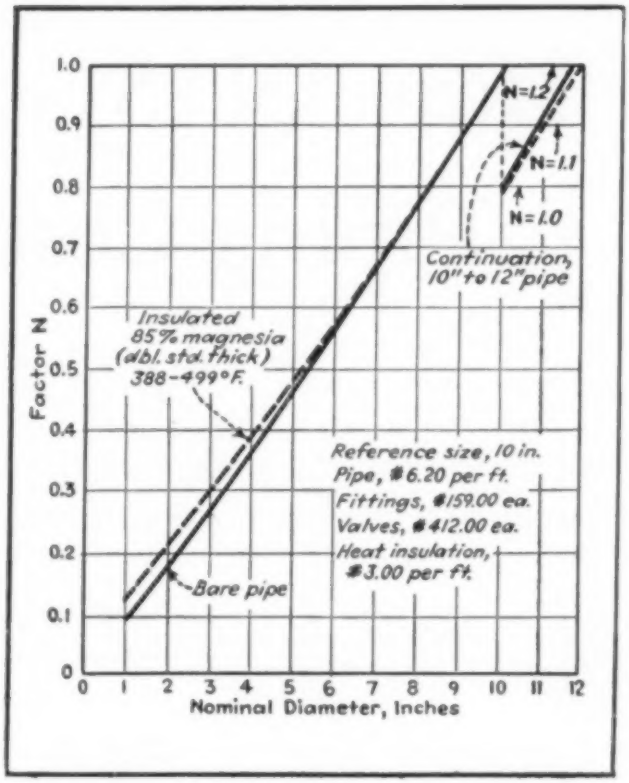
The curves in Figs. 1 to 7 have all been calculated in the manner shown below. To make the method clear, we shall examine how the reference size, and one other size, are determined in the case of Fig. 1. Here 12-in. nominal diameter schedule 40 carbon steel pipe is the basic or reference size, at which N is 1.0. Our problem is to find the cost in place of 1 ft. of such pipe, with one valve and one fitting.

For 1,000 ft. of 12-in. pipe the cost is $2,970. For this length use 10 flanges of 12 x 19 in. size, which take 75 bolts, $\frac{7}{8}$ x 3½ in. This will come to $170 and $8 respectively. Other materials will include six 13 x 16 in. gaskets at $3; 75 lb. of welding rod at $5; and $69 of miscellaneous materials; or a total of $3,225 for materials for the string. Labor will include: handle and haul, $30; pipe fitters, $1,584; welders, $462; and miscellaneous labor, $249; or a total of $2,325 for labor for the string. Total cost, then, will be $5,550 for labor and materials, or $5.55 per ft. of pipe.

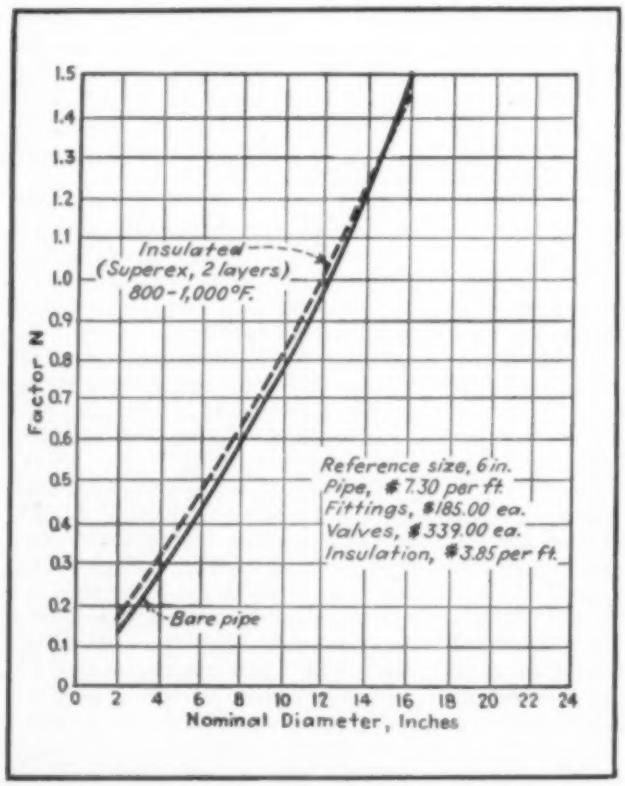
The costs of one valve and one fitting are approached similarly. One 12-in. valve at $337 will require two 12 x 19 in. flanges at $34; 24 bolts $\frac{7}{8}$ x 3½ in. at $3; and two 12 x 16 in. gaskets, 5 lb. of welding rod and miscellaneous materials totaling $46. This $420 of materials will involve labor to the extent of: $5 for handle and haul; $24 for pipe fitters; $18 for welders; and $13 for miscellaneous, a labor total of $60. This brings the labor and mate-


Factor N
Nominal Diameter, Inches
Bare pipe
Cold insulation, Brine thickness cork, -20 to -50 F.
Heat insulation, 85% magnesia (Std. thick) 212-266°F.
Reference size, 12 in. Pipe, $5.55 per ft. Fittings, $140.00 ea. Valves, $480.00 ea. Heat insulation, $1.84 per ft. Cold insulation: Calc. bare pipe and multiply by factor from cork curve
Bare pipe

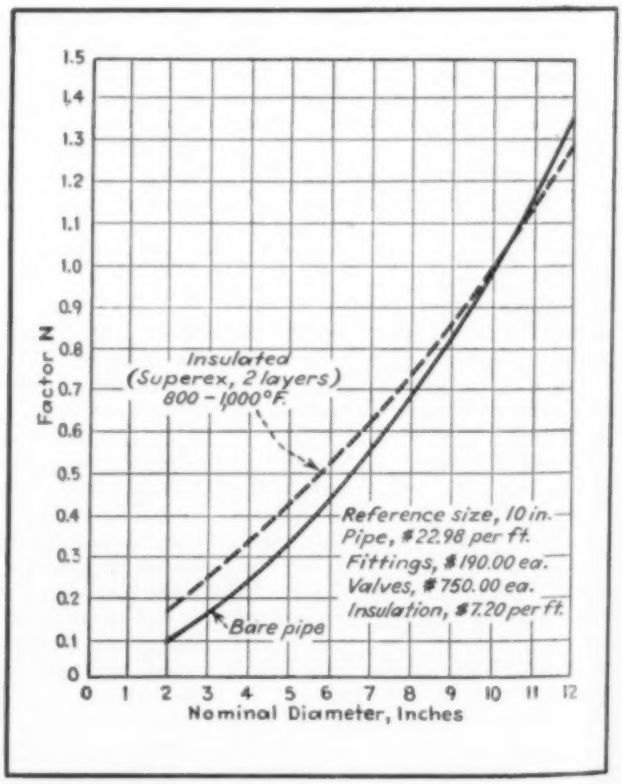
1 Standard weight (schedule 40) carbon steel pipe and welding fittings, with series 15 flanges and valves


Factor N
Nominal Diameter, Inches
N=1.2
N=1.1
N=1.0
Continuation, 10" to 12" pipe
Insulated 85% magnesia (dbl. std. thick) 388-499°F.
Reference size, 10 in. Pipe, $6.20 per ft. Fittings, $159.00 ea. Valves, $412.00 ea. Heat insulation, $3.00 per ft.
Bare pipe

2 Extra heavy (schedule 80) carbon steel pipe and welding fittings, with series 30 flanges and valves

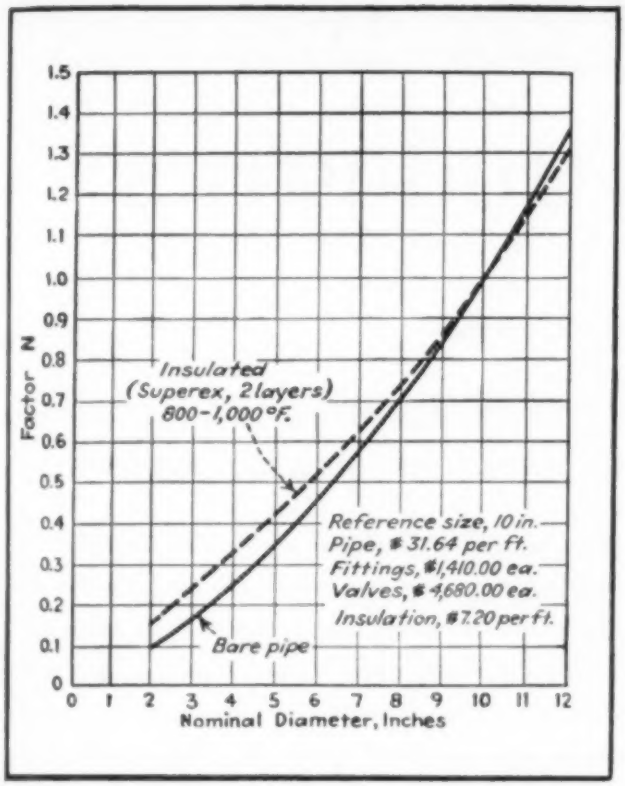

Factor N
Nominal Diameter, Inches
Insulated (Superex, 2 layers) 800-1,000°F.
Reference size, 6 in. Pipe, $7.30 per ft. Fittings, $185.00 ea. Valves, $339.00 ea. Insulation, $3.85 per ft.
Bare pipe

3 Double extra heavy (schedule 160) carbon steel pipe and welding fittings, with series 60 flanges and valves

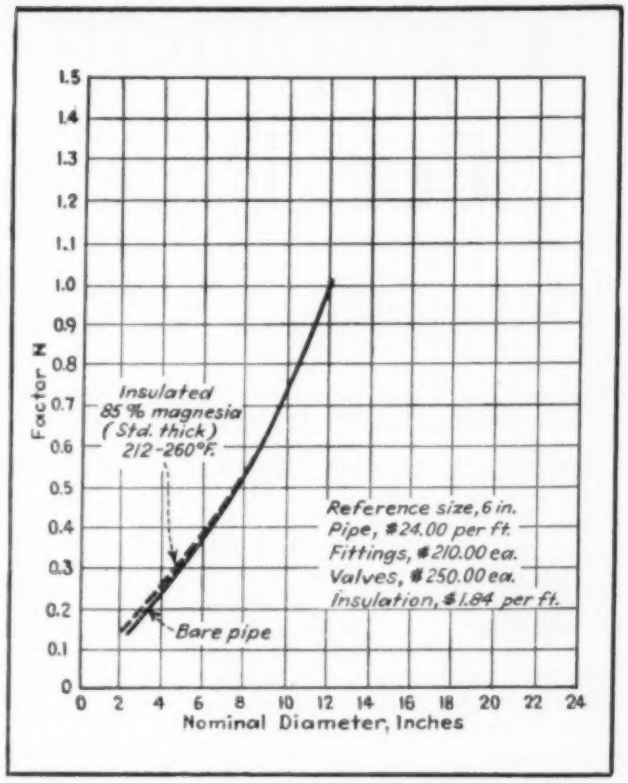

Factor N
Nominal Diameter, Inches
Insulated (Superex, 2 layers) 800-1,000°F.
Reference size, 10 in. Pipe, $22.98 per ft. Fittings, $190.00 ea. Valves, $750.00 ea. Insulation, $7.20 per ft.
Bare pipe

4 Standard weight 4-6 percent chrome steel pipe and welding fittings, with series 150 flanges and valves (ring joints)

These charts, as well as Figs. 5 and 6, are based on cost of pipe in place, but excavation, supports, etc., are extra. Figs. 1 to 5 are based on having all joints welded except valve flanges.



5 Extra heavy 4-6 percent chrome steel pipe and welding fittings, with series 150 flanges and valves (ring joints)



6 Iron pipe size standard weight brass pipe, with 150-lb. flanged fittings and valves

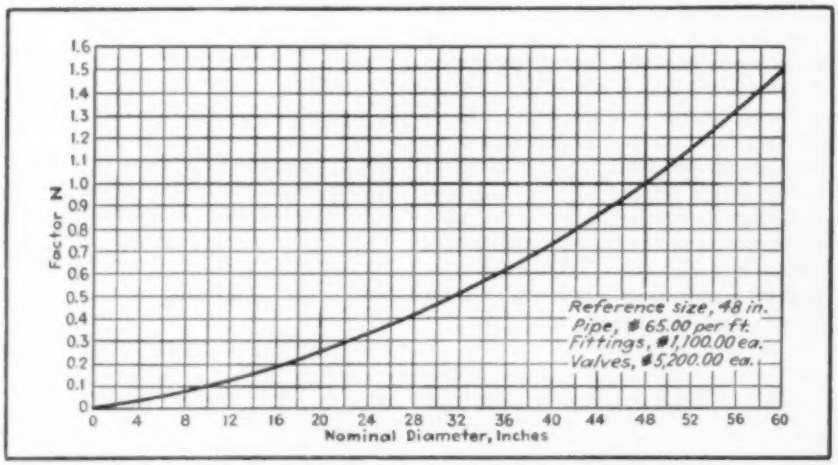
rial total for the one valve to $480.

In the case of a fitting, one 12-in. welding tee at $95, plus $1 for welding rod and miscellaneous materials, brings the material total to $96; while the labor cost will include: $5 for handle and haul; $4 for pipe fitters; $28 for welders; and $7 for miscellaneous, or $44 for total labor. The sum of labor and material is then $140.

Using these figures it is now possible to calculate the cost of a string of pipe of reference size and of any length, for example, 535 ft., with five fittings and two valves. For schedule 40 carbon steel pipe in the 12-in. size, this string would come to: 535 ft. pipe at $5.55 per ft., $2,969; plus five fittings at $140 ea., $700; plus two valves at $480 ea., $960; totaling $4,629.

To obtain a point on the curve of Fig. 1 we can calculate the cost of the same string in 8-in. pipe, and determine the Y value as: 535 ft. pipe at $3.42 per ft., $1,830; plus five fittings at $81 ea., $405; plus two valves at $251 ea., $502; or a total of $2,737.

Then $Y/X = N$ or 2,737/4,629 = 0.595, which is the N value on the curve of Fig. 1 for 8-in. pipe, that is, the multiplier of the cost of the reference string to secure the cost of the required string. As a check of the consistency of the method, 1942 figures show a value of $Y = 2,290$, $X = 3,085$ and $N = 0.600$.



7 Cast iron bell-and-spigot Class C pipe; covers pipe in place including excavation 8 ft. deep in hard ground

What Dave Whitely and his gang did to get the costs of the Chief's pipeline was to count up the fittings and valves from his map and get out Dave's curve for extra heavy (schedule 80) steel pipe. The reference size was 10-in. so Dave figured his reference string and multiplied by the factors, 0.77, 0.57 and 0.37 for 8, 6, and 4 in. pipe (from Fig. 2). He had told the conference he would be within 10 percent; as a matter of fact he was within 6 percent of what he would have obtained by calculating the costs in the conventional way. The extras for the gas line, such as knockout drums, culverts, sleeves, pipe supports, excavation and back-fill would be common to all sizes and the costs could be culled from the files.

Perhaps the most outstanding merit of the factor N system is that it is necessary to keep up to date on only the reference size for each kind and weight of pipe commonly used. "Front" offices may safely endorse the use of the system without reservation for, as already shown, the factor for a string taken at random is practically the same now as it was in 1942.

Equipment Cost Indexes For Process Industries

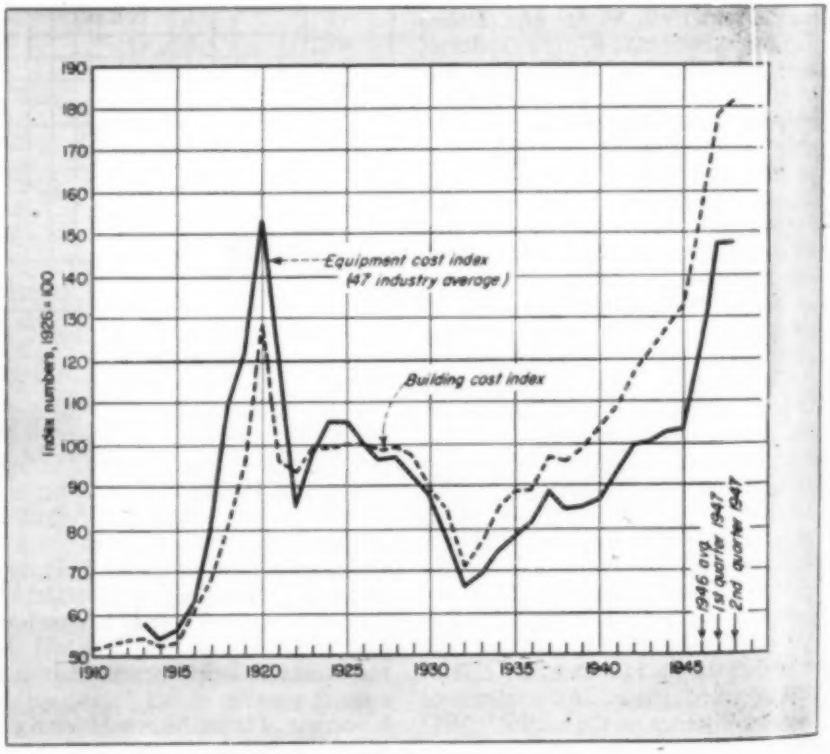
ROBERT W. STEVENS
Partner, Marshall and Stevens, Chicago, Ill.

ESTABLISHED IN 1937, MARSHALL AND STEVENS EQUIPMENT COST INDEXES INCLUDE EIGHT PROCESS INDUSTRIES AND FOUR RELATED INDUSTRIES

PROCESS EQUIPMENT COSTS

ALTHOUGH many indexes are published regularly in the field of construction costs, comparable indexes for equipment costs are somewhat unusual. However, in connection with the valuation service rendered by the author's organization, this firm developed and has published since July 1937 comparative cost indexes for 47 different types of industrial, commercial and housing equipment. This article has the purpose of introducing and explaining a selected group of these indexes which are of especial interest to engineers in the process field. Bearing in mind certain limitations to be mentioned later, they will serve (with future appearances of the several series in this magazine) to present a continuing picture of equipment cost variation with time, in the particular process industries covered. They should, therefore, prove useful in pre-

Since 1937 the firm of valuation engineers of Marshall and Stevens has issued quarterly index numbers for comparative equipment costs for 47 different industries and commercial ventures. These are regularly available to the firm's subscribers. Included among them are index series for eight process industries, another industry using similar equipment in large part, and three more related industries using equipment which is typical of process plant equipment for steam and electric power and refrigeration. This article introduces these series, carrying them back to 1913. It is planned to continue them at intervals for the benefit of Chemical Engineering *readers.*



Comparison of building costs and average equipment costs, 1913 to 1947

Editor's Note—In our May 1947 issue we introduced what we hoped would be a new index of complete chemical plant costs. Offered experimentally, with the proviso that the index would be improved from time to time as it could be tested and refined, it was based on two existing indexes, the *Engineering News-Record* Construction Cost Index, and the Bureau of Labor Statistics Index of Prices of General and Auxiliary Machinery. Very unfortunately immediately after introduction of our index the Bureau found it necessary to discontinue the machinery price index owing to reduced appropriations. The effect is that, until and if the Bureau's index is revived, the complete plant cost index cannot be continued. A happy circumstance makes it possible to introduce here a superior substitute in the Marshall and Stevens indexes for comparative equipment costs in various individual process industries. Through the courtesy of the Marshall and Stevens organization these quarterly index numbers will be made available at intervals to *Chemical Engineering* readers. When used in conjunction with various available construction cost indexes they should make it possible to estimate good approximations of complete plant cost variations. When used alone they give the estimator a tool for judging cost variations with time, for installed equipment in process industries.

Marshall and Stevens Indexes of Comparative Equipment Costs, 1926 = 100

Industry	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
Average of all	57.9	54.1	55.9	62.8	81.5	109.7	122.0	153.3	115.5	85.5	97.8	105.3	105.3	100.0	96.0	96.5	91.9	87.0
Process Industries																		
Cement mfg.	58.0	55.0	55.0	62.5	80.4	109.1	118.4	149.2	113.6	83.7	95.9	104.6	104.7	100.0	96.5	97.2	92.5	87.0
Chemical	59.0	55.0	56.6	63.0	81.2	111.9	120.6	150.5	113.9	82.5	95.0	105.6	107.2	100.0	100.0	96.9	92.4	82.0
Clay products	60.7	56.7	58.1	65.3	84.6	120.0	128.8	154.3	116.6	82.9	96.6	105.7	105.8	100.0	96.5	97.0	91.7	86.1
Glass mfg.	58.7	54.5	56.2	63.5	83.5	112.1	121.9	151.1	114.7	83.7	96.3	101.9	104.5	100.0	96.2	95.9	92.1	86.6
Paint mfg.	58.2	55.2	55.8	62.8	80.0	108.0	119.8	148.5	116.3	84.1	95.8	104.0	103.4	100.0	94.1	94.6	91.7	85.7
Paper mfg.	60.4	55.3	55.8	63.4	81.0	111.8	121.4	152.6	114.8	83.1	95.6	105.6	106.3	100.0	96.2	96 8	90.9	86.5
Petroleum ind.	58.9	55.1	56.6	64.1	83.2	113.0	122.1	151.5	116.4	82.7	96.3	106.0	105.0	100.0	96.5	97.1	92.0	86.2
Rubber	58.6	55.6	57.4	63.8	81.7	113.8	123.3	154.2	116.2	88.0	96.3	105.9	108.7	100.0	96.4	91.9	91.9	86.2
Related Industries																		
Elec. power equip.	59.1	55.2	56.7	64.3	83.1	114.2	128.6	152.2	116.0	83.6	96.2	106.0	104.9	100.0	96.2	96.9	91.8	86.1
Mining, milling	56.8	55.8	56.5	62.9	82.0	111.9	120.3	149.9	114.1	82.8	95.3	105.6	107.1	100.0	96.7	97.2	92.9	86.7
Refrigerating	59.3	56.3	57.1	63.2	83.2	113.5	122.9	153.5	116.7	83.9	96.5	96.1	109.9	100.0	96.3	97.0	92.0	86.4
Steam power	59.1	56.2	56.8	64.3	83.1	114.2	127.6	152.2	115.7	82.7	96.3	106.1	105.0	100.0	96.4	96.9	91.8	86.2

Industry	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	6/1947
Average of all	76.9	66.1	69.4	74.6	78.0	81.6	88.3	84.4	84.8	86.6	92.6	99.6	100.5	102.4	103.4	123.2	147.5
Process Industries																	
Cement mfg.	76.8	68.9	70.7	75.7	78.1	82.2	88.8	85.2	84.6	85.4	90.8	97.8	98.3	98.6	99.4	119.7	140.9
Chemical	78.0	77.6	70.9	75.4	78.5	82.5	88.2	84.4	83.8	84.6	93.3	102.0	103.1	105.6	106.5	126.8	147.9
Clay products	78.0	70.6	71.1	75.7	79.3	83.2	87.8	83.2	82.7	83.7	87.6	93.1	93.6	93.9	94.8	115.0	136.2
Glass mfg.	77.9	69.4	71.2	75.4	78.5	82.6	88.0	83.4	83.0	84.3	88.2	93.7	94.7	96.5	97.4	117.6	138.8
Paint mfg.	76.6	71.7	70.1	74.6	77.2	81.5	87.4	83.9	83.9	84.9	90.3	97.3	98.3	100.1	101.0	121.2	142.4
Paper mfg.	77.1	67.2	69.9	75.4	78.5	82.7	88.1	84.8	84.1	85.1	90.5	97.5	98.7	101.3	102.2	122.4	143.6
Petroleum ind.	77.6	70.1	70.6	76.0	78.7	82.6	87.8	83.3	82.3	82.8	88.2	95.2	96.7	100.0	100.9	121.6	143.3
Rubber	77.0	67.1	70.7	75.2	78.1	82.2	88.4	85.4	85.2	86.3	94.2	102.7	103.7	105.5	106.4	126.6	147.8
Process ind. avg.	77.7	73.2	71.3	75.5	79.0	82.4	88.2	84.3	83.6	84.4	91.5	99.2	100.6	102.9	103.8	123.0	145.5
Related Industries																	
Elec. power equip.	78.1	70.1	70.7	75.5	78.7	82.7	87.9	84.3	84.1	85.8	90.5	96.5	97.5	99.3	100.2	122.9	146.6
Mining, milling	76.8	67.6	80.0	85.6	88.5	92.4	97.1	92.6	92.1	93.1	98.5	105.5	106.2	107.3	108.2	128.4	149.6
Refrigerating	75.0	70.0	71.3	75.4	78.9	83.0	87.5	83.0	82.[illegible]	83.1	89.0	95.8	97.0	100.1	101.7	125.7	159.3
Steam power	88.1	70.1	70.7	75.5	78.7	82.7	87.0	82.2	81.7	82.7	86.6	92.1	92.8	93.9	94.8	116.0	138.2

liminary cost estimation when data of an earlier period are to be "factored up" to the time of estimating.

Average of All

The first series shown in the accompanying tabulation, the Average of All, gives the annual and current averages of the entire 47 groups. It is not the average of the eight process industry indexes which follow it, but is simply the arithmetic average of the 47 separate indexes. An attempt to produce a weighted average might be an impressive mathematical exercise, but it would have little or no meaning, since the Average of All is within less than 15 percent of both the highest and the lowest current indexes. In our practice we have come to regard a reasonable estimating limit to be about 15 percent. It could hardly add much significance to this Average of All which, after all, should be considered only as a visual comparative approximation of all equipment costs. Nor would such an operation provide the estimator with a sharp tool. Estimators, more often than not, must be reconciled to blunt or inadequate tools.

The eight process industry indexes listed in the tabulation, and the four related indexes, are part of the 47 mentioned. For these figures since 1931 a simple weighted process industry average is given,* which is perhaps somewhat more reliable than the arithmetic.

The individual indexes are not based upon the cost, periodically reported, of a certain machine or group of machines utilized in an industry. Instead, they are based upon detailed equipment appraisals made by ourselves and others over the years, back as far as 1919. As many of these reports as were available in any one industry were analyzed and the figures broken down into the following schedule: (1) Machinery and major equipment; (2) installation labor; (3) plant furniture and fixtures; (4) tools and minor equipment; and (5) office furniture.

No consideration was given to plant buildings as we maintained separate series of building indexes and were interested in developing equipment figures only. Land, of course, was omitted. No major transportation equipment was included, viz., railway cars and licensed motor vehicles, but trucks, haulage motors, and other vehicles used exclusively within the plant were included.

It will be understood that the above schedules could be applied only to manufacturing plants. Commercial enterprises were scheduled differently.

The schedule shown was modified by taking from the Machinery and Major Equipment category all items generating or applying power to the operation or process. In instances wherein tankage and piping represented prominent values, separate categories were set up for them. Process tools and small equipment, the latter being for the most part auxiliaries of the major process units, were separated from maintenance tools. Furniture and appliances, not directly productive, whether in plant or office, were grouped as administrative equipment. Thus, the following revised categories were formed: (1) Process or operating machinery, including also (a) tankage and (b) pipe and fittings; (2) power equipment; (3) installation labor; (4) maintenance equipment; and (5) administrative equipment.

Category Indexes

This segregation enabled us to use what may be termed sub-indexes or category indexes over and over again in computing indexes for our 47 industries. Assume for the moment that we are computing an index for paint manufacturing: Category (1), Process Equipment, would be the only category which would require individual research. Prices for grinders, paint mills, mixers, etc., would have to be secured from manufacturers of these specific items but the other category indexes might be applied to many industries. Tankage, pipe and fittings, maintenance equipment take the same general form in one plant as in an-

*Weighting is on the basis of the total product value of the several industries, where the following approximate percentages apply in a typical year: Cement, 2; chemicals, unclassified, 48; clay products, 2; glass, 3; paint, 5; paper, 10; petroleum, 22; and rubber, 8. Chemicals is obliged to carry by far the largest percentage since separate indexes are not available for numerous industries which must therefore be lumped in this general group. The contribution of each of the eight industry groups is obtained by multiplying its respective percentage into its index for the year in question, then adding all the figures so obtained.

other; this paint factory would doubtless be driven by motors no different from those in a neighboring machine shop or bakery. There is no essential difference between the office furniture in a paint factory and that of a department store. The labor sub-index may be generally applied to all types of installation labor.

Percentage Rating

Each category was then given a percentage rating determined by the costs which its total bore to the total plant cost. In computing indexes, both prior and subsequent to 1937, each subindex representing a category was included within the total industry index as indicated by the percentage determined for what might be termed the hypothetical pilot plant. For example, the oil industry index contains the following component percentages: Process Machinery 25 percent, Tankage 24 percent, Pipe and Fittings 12 percent, Installation Labor 19 percent, Power 12 percent, Maintenance Equipment 2 percent, and Administrative 6 percent.

The next step was to reprice selected items from each category for the years prior to and including 1937, the initial year of publication. The appraisals from which the basic data were taken were not as of any single year but had been made in various years between 1919 and early 1937 with a few going back to the period 1913-1919. Thus, they were usable in two ways; first, they provided the means of setting up the schedule of categories or classifications above outlined; in the second place, they outlined costs for the years when they were made.

Most of the repricing was done from our own records, a little of it from other sources which afforded scant help. When duplicate costs could not be found, as was fairly often the case, the nearest equivalents were compared for the years in question. By these means we developed sub- or category indexes, 1913 to 1937, and these were then applied according to indicated percentages to form the industry indexes.

Since 1937, we have brought our indexes up to date quarterly by a method which is probably unorthodox statistically, but which seems to have achieved reasonably realistic results. We first divided the 47 industries or commercial undertakings into six general classes, depending upon the origin of the equipment used in the industry.

Next we developed a formula for each of the six general classes based upon the latest costs of basic materials and labor. Our three sources of the data so employed were Wholesale Prices, and Wages and Hours provided by the Bureau of Labor Statistics, and the monthly construction reports of *Engineering News-Record*. The solution of each formula provides us with the preliminary increase or decrease applicable to each general class. The final step, and a very important one, is to modify or correct, if necessary, the indicated increase or decrease by comparing it with whatever costs, plant records, of other pertinent information we have collected over the preceding three months in connection with our appraisals.

If current actual costs or detailed appraised costs indicate that an index produced by the formulas is out of line, we adjust the index. In fact, we consider the quarterly indexes as preliminary throughout the year and may adjust any of them at any period during the year. The formula-produced preliminary indexes have in most series, proven very well in line with the actual cost or appraised examples with which they have been compared and so the adjustments are rarely large.

Finally, to the indexes computed as above outlined, we may or may not apply what we term a "bargaining factor". This is a modifier developed from general business indicators—business population, business failures, stock prices, bank deposits, manufacturers' shipments, construction activity, etc. Primary sources are the Departments of Labor and Commerce, Dun & Bradstreet, Standard and Poor's Corp., and the Federal Reserve System. These economic data are grouped in "The Handbook of Basic Economic Statistics" published by Government Statistics Bureau of Washington, D. C.

Correcting the Indexes

This bargaining factor is not to be confused with the intangible or premium factor dealt with in a following paragraph. The bargaining factor reflects *normal* variances in costs, the premium factor *abnormal* variances. The bargaining factor may increase or decrease a computed index, depending upon our estimate of economic conditions as of the date of the index. Savings may be made in plant construction if conditions are favorable; i.e., if competent labor is in adequate supply; if healthy competition exists between contractors, and machinery and equipment suppliers; if transportation facilities are plentiful; if financing presents no obstacles. On the other hand, if such conditions are unfavorable, costs tend to increase. We have found, for instance, that the existence of a large and active second-hand market tempers the costs of new installations.

The intangible or premium factory is something separate and apart from our judgment-modified mathematical computation of the plant equipment series. It is unmeasurable mathematically by combinations of materials and labor. Its existence, however, over the past half dozen years has been a matter of common knowledge. Almost every abnormal difficulty incidental to plant construction has lately plagued the constructor. Shortages of materials and labor with consequent delays, strikes, labor inefficiency, extortionate profits or fees collected by prime and sub-contractors, a dearth of bidders, war restrictions, priorities, etc., are some of them. No one can do more than make an intelligent guess as to the effect these unfortunate circumstances have upon plant erection. We have kept our computations of indexes free of these elements. Their effect has lessened and will, we believe, continue to decrease to eventual elimination. We have simply been advising our subscribers to add 5 to 25 percent, depending on local circumstances, to the results obtained through the indexes.

Use of Indexes

Now a few words of caution in the use of these indexes. No index, we believe, can be more than a very general estimate. Moreover, our indexes were developed primarily for the use of insurance people, as a guide to the insurance that should be carried on plant equipment with changing values. It was not contemplated that the indexes would be used by estimators, even for preliminary cost estimating. However, they should prove adequate if their use is restricted to general and preliminary indications only. Later preconstruction estimates should always be the result of a carefully detailed quantity survey.

It should be emphasized that these indexes apply to certain industries as a whole, not to plants processing one or more specific products. Thus, the one index for chemicals spans the entire range from drugs and cosmetics, to building board and insulation. Furthermore, it must be recognized that comparisons of past with present are often based, and necessarily so, on rather shadowy premises. It is only necessary to consider the technologic change that has taken place in the last 30 years in, say, the petroleum industry, to realize that the best we can expect to do is to compare today's plant with what we hope is its reasonable facsimile of the past.

CALCULATIONS For High Vacuum Systems

W. P. DRYER

Mechanical Engineer, Stone & Webster Engineering Corp., Boston, Mass.

HOW FLUID FLOW DIFFERS IN THE HIGH VACUUM RANGE FROM THAT AT CONVENTIONAL PRESSURES IS DEALT WITH IN TWO IMPORTANT ARTICLES

IN THIS and a second article to follow, methods and equations are given for calculating the size of equipment used in creating high vacuum in vessels of industrial size. The equations are presented in terms and units that engineers will readily understand and be able to apply; they are, in fact, the practical formulas for the resistance to flow of gases at low pressure. The methods given here have been found applicable in designing extensive vacuum systems where the vessels evacuated have volumetric capacities of several hundred cubic feet and where the final pressure obtained is below 10^{-4} mm. Hg.

In evacuation from atmospheric conditions to such a low pressure, the flow of gases in the early stages of the process is viscous and in the last stages is free molecular. In the intermediate stage the flow is a combination of viscous and free molecular. Since in these different kinds of flow the dynamic action taking place between the flowing molecules is different, the laws of resistance to flow are different. For example, within certain limits the pressure lost, in a gas flowing in a pipe at a constant mass rate under isothermal conditions, varies inversely as the fourth power of the diameter of the pipe if the flow is viscous, and as the third power if free molecular. (It will be recalled that in turbulent flow it varies inversely as the fifth power.) Equations will be given for the resistance to viscous flow, to free molecular flow, and to combined viscous and free molecular flow, and it will be shown what the limits are for each of these three kinds.

Mechanical Pumps

In evacuation from atmospheric pressure, mechanical pumps are commonly used to reduce the pressure down to about 100 microns Hg (1 micron equalling 0.001 mm. Hg). In so doing the process occurring in many applications is simply the withdrawing of noncondensible gases previously inclosed in the vessel, the condensible gases being removed by cold traps. It will be shown how to compute the size of pumps and pipes for such a process and to determine the length of time taken for it.

For extending evacuation to lower pressures, oil diffusion pumps are brought into play. These pumps operate by trapping molecules which in their individual random kinetic flight happen to strike into the pumps. For this action to take place to any degree, the length of the free path of the molecule must be of the same order of magnitude as the size of the entrance into the pump. The mean free length of path of a molecule at normal temperature is about 2½ in. when the pressure is 1 micron Hg. Modern large diffusion pumps begin to come into operation when the pressure at the entrance of the pump has been reduced by other means to a pressure of about 100 microns Hg, and they become fully operative at pressures somewhat less than 1 micron Hg. These pumps can carry the pressure down below 10^{-6} mm. Hg (10^{-3} microns). Throughout the range of pressure in which diffusion pumps operate, the process of evacuation is not simply one in which gases already in the vessel are withdrawn. In this range large quantities of other gases are evolved from the

To most engineers properties of fluids at pressures in the low micron range are still largely unknown. Until recently free molecular flow has been a rarity outside the physical research laboratory and the electronics field. This paper and one to follow it have as their objective the presentation of equations enabling engineers to deal with calculations whether in the viscous range, the free molecular flow range, or the intermediate range where both exert influence.

This paper and the one by the same author which will follow it are based on work performed under Contract Nos. W-7401-eng-13, W-14-108-eng-49, and W-14-108-eng-60 for the Manhattan Project at the Stone & Webster Engineering Corp. The information covered in these two papers will appear in Division I of the Manhattan Project Technical Series, as a part of the contribution of the Stone & Webster Engineering Corp.

surfaces inside the vessel, from evaporation of constituents of the materials of the surfaces, and from substances contained in the vessel. Were it not for these evolved gases, a diffusion pump having a constant volumetric capacity of 10,000 liters per sec. could reduce the pressure in a 100-cu.ft. vessel one-thousand fold, from 10^{-3} mm. Hg to 10^{-6} mm. Hg, in a few seconds. In actual practice, with such a pump and vessel the evacuation will often take hours and sometimes days. The time may be shortened by excluding from the vessel, as far as possible, materials and substances which would evolve gases. Between the initial and final conditions of pressure and temperature, a certain mass of gas will be evolved and this mass will be liberated more quickly and the length of time of evacuation shortened by heating the interior of the vessel.

It will be seen, therefore, that the diffusion pump capacity to be selected for any application depends altogether on the particular conditions prevailing and that no general rule can be given. However, in what follows, guidance will be given to the designer in shaping and sizing the avenues of escape of the diffusing molecules. To the extent that the avenues inside the vessel and the ducts between it and the diffusion pump offer impedance, the effective pumping capacity is reduced and the time of evacuation prolonged.

Viscous Flow Resistance

Poiseuille's law of viscous flow in a round pipe is commonly expressed in some such equation as the following:

$$\Delta P = \frac{32\,Z\,L_p V}{g\,D^2} \qquad (1)$$

where L_p is length of pipe in feet; D is diameter of pipe in feet; V is average velocity of fluid in feet per sec. (i.e., vol./sec. ÷ area); Z is viscosity in lb. per sec. ft.; g is 32.2; and ΔP is pressure drop in length L_p in lb. per sq. ft.

Equation (1) will hold for any length of pipe if the fluid is incompressible; there throughout L_p the velocity V is constant, and with isothermal flow Z is constant. For a gas or vapor, however, V increases along L_p, because the volumetric rate of flow increases with decreasing pressure; in this case Eq. (1) holds only for an elementary length, thus:

$$dP = \frac{32\,Z\,dL_p V}{g\,D^2} \qquad (2)$$

where dP is the pressure drop in lb. per sq. ft. occurring in the elementary length dL_p ft.

The units in Eq. (2) can readily be converted to the units used in high vacuum work, and the pressures in the elementary lengths integrated over the whole length of the pipe, to give Eqs. (7) and (8) for compressible fluids. (For those who wish to follow it, the derivation* is given in the accompanying footnote.) Knowing the pressure and volumetric rate of flow at the entrance to the pipe, the pressure at the exit u_2 is found by Eq. (7); the conditions at the exit being known, u_1 is found by Eq. (8).

$$u_1^2 - u_2^2 = 55{,}600\,Z\,Lu_1 f_1/d^4 \qquad (7)$$

also,

$$u_1^2 - u_2^2 = 55{,}600\,Z\,Lu_2 f_2 d^4 \qquad (8)$$

where u_1 is pressure at the entrance to the pipe in microns Hg; u_2 is pressure at the exit of the pipe in microns Hg; Z is viscosity in lb. per sec. ft.; L is whole length of pipe in inches; f_1 is liters per sec. at the entrance to the pipe; f_2 is liters per sec. at the exit of the pipe; and d is diameter of the pipe in inches. The gas is assumed to obey the ideal gas law, and the flow is assumed to be isothermal.

Air Flow Resistance

Equations (7) and (8) applied to air at a temperature of 80 deg. F. (300 deg. K.), by substituting for the value of Z the viscosity of air at that temperature, gives Eqs. (7a) and (8a) as follows: The viscosity of air at 80 deg. F. is 0.0182 centipoises. Multiplying centipoises by 0.000672 gives lb. per sec. ft., so $Z = 0.0182 \times 0.000672 = 12.2 \times 10^{-6}$. The viscosity of gases is independent of pressure. Hence for 80 deg. F. air at any pressure, and isothermal conditions:

From (7), $u_1^2 - u_2^2 = 0.68\,Lu_1 f_1/d^4$ (7a)

From (8), $u_1^2 - u_2^2 = 0.68\,Lu_2 f_2/d^4$ (8a)

The nature of the flow of gases or vapors may be turbulent, or viscous, or free molecular, or a combination of viscous and free molecular. The ranges in which viscous flow resistance formulas may be used will now be shown.

Viscous Flow Pressure Range

1. *Upper Pressure Limit*—The flow will be turbulent or viscous, depending on the pipe diameter, density and viscosity of the fluid flowing, and on the velocity of flow. The criterion used to determine which of the two kinds of flow occurs is that it is viscous if Re (the Reynolds number) is less than 2,200, and turbulent if more than 2,200. Theory and experiment show that:

$$Re = DV\rho/Z \qquad (9)$$

where D, V, ρ and Z are in any consistent units, such as: D = diameter of pipe in feet; V = velocity of flow in ft. per sec.; ρ = density of fluid in lb. per cu. ft.; and Z = viscosity of fluid in lb. per sec. ft.

As an example, let us use the Reynolds number 2,200 as a criterion to ascertain the upper limit of the range wherein the flow of air at 80 deg. F. would be viscous. Since it would be so when $DV\rho/Z$ is less than 2,200, then putting this in vacuum units and for air at 80 deg. F., the flow will be viscous when:

uf/d is less than 510,000 (10)

where u = pressure of the air in microns Hg; f = rate of air flow in liters per sec.; and d = pipe diameter in inches.

Equation (10) is derived by making the following substitution in Eq. (9): $D = d/12$; $V = 6.5f/d^2$; $Z = 10^{-6} \times 12.2$; and $\rho = 0.0736\,u/760{,}000$, since the weight of 1 cu. ft. of air is 0.0736 lb. at a pressure of 80 deg. F. and 1 atm., or 760,000 microns Hg. So when Re is less than 2,200, then $[d/12(6.5f/d^2)0.0736u] \div [(10^{-6} \times 12.2) \times 760{,}000]$ is less than 2,200; hence, when uf/d is less than 510,000 the flow of 80 deg. F. air is viscous.

2. *Lower Pressure Limit*—At all rates of viscous flow of gases, more flow actually occurs for a given pressure drop in a pipe than is indicated by viscous flow resistance equations alone. By diffusion there is in addition a free molecular flow of gas but the amount is relatively negligible at pressures above a few hundred microns Hg. At lower pressures the amount has to be reckoned with.

Since as will be shown later the lower the pressure of gas in a pipe, the more will the free molecular flow be relative to the viscous flow, a practical limit can be set for the lowest pressure at which only the viscous flow resistance Eqs. (7), (8), (7a), and

---

* To convert Eq. (2) to units convenient for vacuum work, pressure drop is converted to microns Hg, length and diameter to inches, and flow rate to liters per sec. Since 14.7 psi. abs. = 760 mm. Hg, then 1 psf. = 359 microns Hg. $L_p = L/12$. $D = d/12$. V in ft. per sec. $= 6.5f/d^2$ by the conversion:

$$\text{Ft./sec.} = \frac{\text{cfs.} \times 144}{d^2 \times 0.7854} = \frac{\text{liters} \times 144}{\text{sec.} \times d^2 \times 28.32 \times 0.7854} = 6.5f/d^2$$

where f is liters per sec.

Substituting in Eq. (2):

$$du = \frac{359 \times 32 \times 144 \times Z \times dL \times 6.5f}{32.2 \times d^2 \times 12 \times d^2}$$

$$du = 27{,}800\,ZdLf/d^4 \qquad (3)$$

where the units are as given in the text. Now letting subscript (1) represent entrance conditions, and subscript (2) exit conditions, and noting that the mass rate of flow must be the same at all cross-sections of the pipe, then for an ideal gas and isothermal flow:

$$u_1 f_1 = u_2 f_2 = uf \text{ at any point}$$

and $$f = u_1 f_1/u = u_2 f_2/u \qquad (4)$$

Substituting the two values of f from (4) in (3):

$$udu = 27{,}800\,ZdLu_1 f_1/d^4 \qquad (5)$$

and $$udu = 27{,}800\,ZdLu_2 f_2 d^4 \qquad (6)$$

Integrating (5) and (6):

$$(u_1^2 - u_2^2)/2 = 27{,}800\,ZLu_1 f_1/d^4 = 27{,}800\,ZLu_2 f_2/d^4$$

which simplifies to the two forms given in Eqs. (7) and (8).

(8a) might be used to indicate the total flow. Let us use these formulas down to the pressure where the molecular flow is 10 percent of the viscous flow, and neglect that extra 10 percent. In a later section on the combined viscous and free molecular flow conductance of pipes, it is shown that the free molecular flow will be 10 percent of the viscous flow when $u_a = 220 \div d$, u_a being the average pressure along the length of the pipe in microns Hg, and d the diameter of the pipe in inches.

Hence, we shall use viscous flow resistance Eqs. (7), (8), (7a), and (8a) down to the pressure where:

$$u_a = 220 \div d \qquad (11)$$

When $u_a < 220 \div d$, free molecular flow is > 10 percent of viscous flow. Conversely, when $u_a > 220 \div d$, free molecular flow is < 10 percent of viscous flow.

Conductance in General

With a given gas flowing through a pipe of a given diameter (or any given channel) under any kind of flow—turbulent, viscous or free molecular—the drop of pressure in a given length of the pipe is proportional to the resistance of the pipe and to the mass rate of flow of the gas. In vacuum units:

$$\Delta u = Kuf \qquad (12)$$

By analogy to electrical flow, $\Delta E = R I$. The resistance R is not necessarily constant for a given circuit, being constant only for isothermal and constant current conditions; and I is a measure of the number of electrons flowing per second in the circuit. So also with Eq. (12), K may or may not be constant for a given gas in a given pipe. It varies with pressure in viscous flow, but is practically independent of pressure in free molecular flow. As in the electrical circuit where C, its conductance, can be used instead of its resistance, giving $\Delta E = I/C$, so also in the pipe its conductance C can be used, giving

$$\Delta u = uf/C \qquad (13)$$

and as with K, C for a given pipe and gas may be variable. Hence,

$$C = uf/\Delta u \qquad (14)$$

This then is the general definition of conductanace in pipes or channels for any kind of flow: Conductance is the mass rate of flow per unit pressure drop. With the units of pressure and flow used in (14), the units of conductance C are liters per sec.

Equations giving the values of the conductances of pipes and various channels will be established later for both viscous and free molecular flow. Having computed the values of the individual conductances in a piping system, the overall conductance of the system can be determined.

Sometimes in vacuum work the pressures of the gas are such that the conductance due to viscous flow only is of appreciable magnitude—say, above pressures of the order of 1,000 microns Hg. At the lowest pressures, say, below the order of 1 micron Hg, the conductance due to free molecular flow only is important. In the range between those pressures both conductances may be of moment.

In cases where the conductances of only one kind of flow (either kind) are appreciable, and where the conductances are in series, one being C_1, the other C_2, then the over-all conductance of both is $C_T = 1 \div (1/C_1 + 1/C_2)$. The validity of so combining conductances in series is shown thus:

Suppose two pipes are in series, one with a conductance C_1, the other C_2, the overall conductance being C_T. The rate of mass flow uf is the same in both pipes. Let Δu_1 and Δu_2 be the pressure drop in the first and second pipe, respectively, and Δu_T be the pressure drop in both pipes. Then from Eq. (13), $\Delta u_1 = uf/C_1$, $\Delta u_2 = uf/C_2$ and $\Delta u_T = uf/C_T$. Since $\Delta u_T = \Delta u_1 + \Delta u_2$, then $uf/C_T = uf/C_1 + uf/C_2$, or $C_T = 1 \div (1/C_1 + 1/C_2)$. All this is for any kind of flow, and C has not been assumed to be necessarily constant for a given pipe and gas.

In the intermediate pressure ranges where the conductances of both viscous and free molecular flow are appreciable, the two kinds of conductance of any pipe or other element are in parallel, and are combined as $C_B = C_V + C_F$, where C_B is the combined conductance of the element; C_V is the viscous conductance of the element; and C_F is the free molecular flow conductance of the element.

If this element is in series with another which has a combined conductance C_B, then as above with series conductances the total conductance may be expressed as $C_T = 1 \div (1/C_B + 1/C_{B1})$.

Viscous Flow Conductance

It has been shown in discussing the theory of conductance of a pipe (or of any channel) that with a given gas flowing in a pipe of given diameter and length, the viscous flow conductance of the pipe C, in liters per sec., is equal to the mass flow in the pipe, in micron liters per sec., divided by the pressure drop in the pipe in microns Hg.

In the range of pressures where both viscous and free molecular flow conductances are appreciable, the combined conductance is the sum of both conductances. For computing the combined conductance it is necessary to express the separate conductances in similar terms and units. Viscous flow conductance will be expressed below in terms and units found convenient in computing free molecular flow conductance.

Conductance Formulas

With viscous flow, the conductance given here for a straight, round pipe is derived directly from the basic viscous flow resistance equations which come from Poiseuille's theoretical law and are confirmed by experiment. These basic equations (7), (7a), and (8a) have already been established. For the conductances of rectangular ducts adaptations of these basic equations are given that have been determined by experimenters and are considered satisfactory.

In all equations given here for viscous flow resistance and viscous flow conductance, the various symbols (with or without subscripts) denote the following: a = length of side of rectangle in inches; b = length of side of rectangle in inches; C = conductance in liters per sec.; d = diameter in inches; f_a = average volumetric flow in length L, in liters per sec.; L = length of pipe, duct or channel in inches; n = a factor depending on b/a, as in the table given below; u_1 = pressure at the entrance in microns Hg; u_2 = pressure at the exit in microns Hg; u_a = average pressure in length L, in microns Hg; Δu = difference in pressure in length L, in microns Hg: and Z viscosity in lb. per sec. ft.

Round Pipe—For air at 80 deg. F. and flowing in a round pipe viscous flow resistance Eq. (8a) has been shown to be $u_1' - u_2' = 0.68\ L\ u_a\ f_a/d^4$. Now if u_2 is not too small relative to u_1, then approximately $2u_a = u_1 + u_2$. Since in Eq. (8a) the lefthand side can be rewritten as $(u_1 - u_2)(u_1 + u_2)$, then (8a) can be rewritten as $(u_1 - u_2)(u_1 + u_2) = 0.68\ L\ u_a\ f_a/d^4$; and since $u_1 - u_2 = \Delta u$, then

$$\Delta u = 0.34\ Lf_a/d^4 \qquad (15)$$

Substituting this value of Δu in Eq. (14) for air at 80 deg. F.:

$$C = 2.94\ u_a d^4/L \text{ liters per sec.} \qquad (16)$$

For any gas at any temperature we can use Eq. (8), the general formula for flow resistance, instead of (8a), obtaining:

$$C = 240{,}000\ Zu_a d^4/L \text{ liters per sec.} \qquad (17)$$

Z being the viscosity of the gas at the

particular temperature in lb. per sec. ft.

Rectangular Ducts—For such ducts let **a** be the long side of the rectangle in inches, *b* be the short side of the rectangle, also in inches. In the equations given below, use the value of *n* found in the following table:

b/a	*n*
0.1	0.032
0.2	0.059
0.3	0.081
0.4	0.100
0.5	0.115
0.6	0.126
0.7	0.133
0.8	0.137
0.9	0.139
1.0	0.140

For air at 80 deg. F. substitute 30 a^2b^2n in place of 2.94 d^4 in the round pipe Eq. (16), obtaining:

$$C = 30\, a^2b^2n\, u_a/L \qquad (18)$$

For any gas at any temperature Eq. (18) can be modified. Since Z, the viscosity of air at 80 deg. F., is 12.2×10^{-6} lb. per sec. ft., then in place of 30 in Eq. (18) we can substitute $30\ Z \div (12.2 \times 10^{-6})$, or $2.46 \times 10^6\ Z$, obtaining:

$$C = 2.46 \times 10^6\, Z\, a^2b^2n\, u_a/L \qquad (19)$$

Equation (14) showed, in the discussion of the theory of the conductance of a channel, that with free molecular flow, the conductance *C* of the channel, in liters per second, is equal to the mass rate of flow in the channel, in micron liters per second, divided by the pressure drop in the channel, in microns Hg.

Free Molecular Flow Conductance

With free molecular flow, it can be shown from the kinetic theory of gases, and confirmed by experiment, that with any given aperture, pipe, duct, or other channel, the conductance for any particular gas at any given temperature is practically constant, its variation with pressure being almost negligible. For a given channel, gas, and temperature in no case can the free molecular flow conductance vary more than about 18 percent. For example, with a 30-in. diameter pipe, it takes a range of pressure roughly from 1,000 microns Hg to 0.001 microns Hg to produce that variation. At the higher pressure the pipe's conductance is a minimum and does not change from that with greater pressure, while at 0.001 microns it is a maximum and does not change from that with any lowering of pressure.

This principle is brought out in Eq. (20), showing the free molecular flow conductance of a long, round pipe with air at 80 deg. F. In this case:

$$C = \frac{79\, d^3}{L}\left(\frac{1 + 0.62\, ud}{1 + 0.76\, ud}\right) \qquad (20)$$

where C is conductance in liters per sec.; *d* is pipe diameter in inches; *L* is pipe length in inches; and *u* is the average pressure in pipe in microns Hg.

From Eq. (20) it is evident that at very low pressures the conductance of the pipe will be 79 d^3/L, and at very high pressures it will be 82 percent of that.

In the equations given below for the free molecular flow conductances of pipes and of typical channels, there is a factor Y which corresponds to the term $(1 + 0.62\ ud) \div (1 + 0.76\ ud)$ in Eq. (20). The following table gives the value of Y to be used in all formulas presented below, for various values of *u*, the average pressure in microns Hg, and *d*, the diameter of pipe in inches. With pipes and channels which are not circular in cross section, for *d* use the diameter of a circle having the same cross-sectional area.

ud	*Y*
0.01 to 0.1	1.00
0.1 to 1.0	0.96
1.0 to 10.0	0.86
10 to 100.0	0.83
over to 100.0	0.82

Molecular Flow Pressure Range

It is shown in a later section on combined viscous and free molecular flow conductance that at the lowest possible pressures, the total conductance of a pipe or other channel is measured by its free molecular flow conductance only; that there is a range of high pressures where the total conductance is measured by the viscous flow conductance only; and that there is an intermediate range of pressure where the total conductance is the combined viscous and free molecular flow conductances. Those measures of the conductance of a pipe of given diameter and length follow from these facts:

1. As was shown in Eq. (16), the viscous flow conductance is directly proportional to the average gas pressure along the length of the pipe.

2. As shown in Eq. (20), free molecular flow is practically constant, irrespective of the gas pressure.

3. Consequently; viscous flow conductance is negligible at lowest pressures, free molecular conductance is negligible at highest pressures and both conductances have to be reckoned with at intermediate pressures.

The pressure range in which the free molecular flow equations alone may be used to measure the total conductance may be taken to extend from the lowest possible pressures up to the pressure where:

$$u_a = 2.2/d \qquad (20a)$$

u_a being the average pressure along the length of pipe in microns Hg, and *d* being inside diameter of the pipe in inches.

The derivation of Eq. (20a) is given in a later section on combined viscous and free molecular flow conductance, where it is shown that where $u_a = 2.2/d$, the conductance of the pipe would be actually 10 percent greater than that computed from free molecular flow formulas alone; that at greater pressures the error would be more, and at smaller pressures less.

Molecular Flow Conductances

The equations given below for the values of conductances of elements of piping and duct systems are stated in the simplified form in which they apply to air at 80 deg. F. at any pressure. However, they will apply to any gas at any temperature by multiplying the values stated by $0.31\ (T/M)^{1/2}$, where *T* is the absolute temperature in degrees Kelvin; and *M* is the molecular weight.

In the equations given below for free molecular conductance, the various symbols (with or without subscripts) denote the following:

A = cross-sectional area in square inches; *B* = perimeter in inches; *C* = conductance in liters per sec.; *d* = diameter in inches; *f* = flow in liters per sec.; *T* = temperature in degrees Kelvin; *L* = length in inches; *M* = molecular weight; *u* = pressure in microns Hg;. Δu = pressure drop in microns Hg; and *Y* = factor depending on *ud*, as in table above.

An Aperture Having an Area Relatively Small Compared to Area Above It—The following aperture formulas are derived from one commonly used and experimentally verified which states that the free molecular flow conductance of an aperture in cubic centimeters per second is equal to $(1.32 \times 10^4\ T/M)^{1/2}$ per sq.cm. of aperture. (This formula neglects the factor Y given in the foregoing table; moreover, it is frequently wrongly applied to apertures which are large relative to the areas above them.)

Hence, for any gas at any temperature:

$$C = 23.5\, A\, Y \sqrt{T/M} \qquad (21)$$

For air at 80 deg. F., $T = 300$ and $M = 29$, so:

$$C = 75\, A\, Y \qquad (22)$$

$$C = 59\, d^2 Y \qquad (23)$$

Eq. (23) is for an orifice of *d* inches in diameter.

Examine Eq. (22) in the light of the definition of conductance given in Eq. (14):

$$C = uf/\Delta u = 75\, A\, Y$$

Letting u_1 be the pressure above the aperture, and u_2 the pressure below the aperture, then when $u_2 = 0$, $\Delta u = u$ and $f = 75\ A\ Y$. But when $u_1 = 8$,

and $u_s = 6$, $\Delta u = 2$ and $f = 18.8\ A\ Y$. This shows that, although the conductance of an aperture is constant, the flow is not.

An Aperture Having an Area Relatively Large Compared to Area Above It (For Air at 80 Deg. F.)—

If A is the aperture area, and A_o is the area above it, then:

$$C = \frac{A_o}{A_o - A} \times 75\ A\ Y \qquad (24)$$

$$C = \frac{A_o}{A_o - A} \times 59\ d^2\ Y \qquad (25)$$

Equations (24) and (25) show that a given aperture conductance becomes greater if the area above it gets smaller. Compare for example the conductance of a 2-in. dia. orifice in a disk blocking a 12-in. pipe, with its conductance when in a disk blocking a 3-in. pipe. Assume $Y = 1$ in both cases. Then from Eq. (25), with a 12-in. pipe, $C = 242$ liters per sec.; while with a 3-in. pipe, $C = 425$ liters per sec.

Pipes and Ducts

Round Pipe—For long pipe of diameter d inches and length L inches, long enough relative to its diameter so that the entrance effect is negligible, the following holds: (When the length is 25 diameters, the entrance effect is only about 5 percent of the total resistance.) In the case of air at 80 deg. F.,

$$C = 79\ d^3\ Y/L \qquad (26)$$

For short pipe of diameter d inches and length L inches, let C_T be the conductance of the short pipe; let C_1 be the conductance of its lengths as found by long tube Eq. (26); and let C_2 be the entrance conductance as found by aperture Eq. (23). Then, $1/C_T = 1/C_1 + 1/C_2$. For air at 80 deg. F.:

$$C_T = \frac{79\ d^3\ Y}{L + 1.34\ d} \qquad (27)$$

Notice that the resistances along the length, and of the entrance, are equal when $L = 1.34\ d$.

Rectangular Duct—In engineering work, the flow from a tank being evacuated to very low pressure is often not into a round pipe, but into a duct which is either rectangular, or has a cross-sectional area comparable to that of the tank. The least confusing method of computing such a duct is as follows:

First, determine C_1, the conductance along the length of the duct, by using Eq. (21) and correcting for rectangularity thus: Let A be the cross-sectional area of the duct, in square inches, and B be the perimeter of the duct's cross-section, in inches. Then for d^3 in Eq. (26) substitute $5.1\ A^2/B$. Hence:

$$C_1 = 400\ A^2\ Y/LB \qquad (28)$$

Next, determine C_2, the conductance of the entrance into the duct, by using aperture Eq. (24), letting A_o be the cross-sectional area of the tank in square inches. Then:

$$C_2 = \frac{A_o}{A_o - A}\ (75A\ Y) \qquad (29)$$

and C, the total conductance of duct, is equal to:

$$C = 1 \div (1/C_1 + 1/C_2) \qquad (30)$$

Example—What is C, the conductance of a rectangular duct 10 ft. long, with a cross-section of 2 ft. by 6 ft., which leads from a tank having 16 sq. ft. cross-section? The pressure is very low and $Y = 1$.

From Eq. (28), $C_1 = 400 \times (12 \times 144)^2 \div (10 \times 12)\ (16 \times 12) = 52{,}000$ liters per sec. From Eq. (29), $C_2 = 2{,}300/(2{,}300 - 1{,}728) \times (1{,}728 \times 75) = 520{,}000$ liters per sec. Finally, from Eq. (30) $C = 1 \div (1/52{,}000 + 1/520{,}000) = 47{,}200$ liters per sec.

Note that if, as is sometimes found in engineering literature, Eq. (29) had been the same as (22) instead of (24), C_2 would have become 130,000, and C would have appeared to be 37,000 liters per sec. instead of 47,200.

Bend or Elbow—For such fittings, circular or rectangular in cross-section, the total resistance apparently works out as being equal to the resistance of the entrance to the bend or elbow (where it joins the straight length), plus the resistance of the length of the bend or elbow measured along the center line as though it were straight. That is, let C_T be the total conductance; C_1 be the conductance of the entrance; and C_2 be the conductance of the length. Then, as in the general discussion of series conductances:

$$C_T = 1 \div (1/C_1 + 1/C_2) \qquad (31)$$

where C_1 is found by Eq. (22) or (23), and C_2 is found by Eq. (26).

Annulus in a Round Pipe, or Passage Between Two Rectangles—The latter condition corresponds to an annular space in a rectangular duct having a rectangular obstruction in it. Two cases are considered, including:

1. Annulus or Passage Formed by a Thin Plate—Take the conductance as being the same as that of an aperture as found by Eq. (22) or (23), the area of the aperture being considered as the same as that of the annulus or passage, that is:

$$C = \text{Annulus area} \times 75\ Y \qquad (32)$$

2. Annulus or Passage Formed by an Object Having Axial Length:—Here, let C_T be the total conductance of the annulus or passage; C_1 be the conductance of its entrance; and let C_2 be the conductance of its length. Then, as in Eq. (31):

$$C_T = 1 \div (1/C_1 + 1/C_2) \qquad (33)$$

where C_1 is found by the thin plate Eq. (32), and C_2 is found through a modification of Eq. (26) in which $16A^2/B$ is substituted for d^3, or

$$C_2 = 400\ A^2\ Y/BL \qquad (33a)$$

where A is cross-sectional area of the annulus or passage in square inches; B is the length of the outer perimeter of the annulus or passage, plus the length of the inner perimeter in inches; and L is the axial length of the object, also in inches.

(The author's second article, to appear in an early issue, will develop equations for viscous flow conductance and for combined viscous and free molecular flow conductance. It will deal also with the time required for pumping and with the sizing of rough vacuum lines.—*Editor.*)

Slurry Screening Device

DESIGN details and operating characteristics of a novel screening device for removing grit and coarse particles from slurries of organic chemicals are described in a report by the Office of Technical Services, Department of Commerce.

The device, now in use at the I. G. Farbenindustrie plant, Leverkusen, Germany, consists of a vertical cylindrical metal vessel or bowl mounted on a portable frame. A concentric ring of fine screen is rigidly fastened inside the bowl and a top driven, close fitting, four bladed impeller rotates within this screen cylinder at variable, but relatively high, speeds. The slurry is fed into the top of the inner screen cylinder where the impeller forces it through the screen partition into an outer collecting bowl. Grit and coarse materials settle to the bottom of the inner receptacle. Average output is 1,000 kg. of screened slurry per hr.

Grit-free slurries of organic products are frequently needed to meet industrial specifications. In printing, for example, it is necessary that vat dye paste be free of hard particles which would damage the copper printing rolls.

The report (PB-77678; **Screening Device for Slurries of Organic Chemicals;** 8 pages, 2 drawings, mimeographed, 50 c.) is available from the OTS, Department of Commerce, Washington 25, D. C.

Process Engineer's Guide to the Centrifugal Compressor—II

IGOR J. KARASSIK

Application Engineer, Worthington Pump & Machinery Corp., Harrison, N. J.

ONE OF THE MOST IMPORTANT FACTORS IN COMPRESSOR CALCULATIONS IS ADIABATIC HEAD, DEALT WITH HERE FOR AIR AND PERFECT GASES

As THE FIRST of these articles (*Chem. Eng.*, Oct. 1947, pp. 98-102) showed, a given pump or compressor, running at a given speed, will transmit to the fluid handled a very definite energy in foot-pounds per pound of fluid. Provided we neglect for the moment the effect of viscosity on the pump performance, this energy will be independent of the nature of the fluid itself and will be a function of the dimensions, angles and areas of the machine and of its operating speed. It corresponds to the term "Total Developed Head" in the cases of both pumps and compressors. The "Total Required Head," on the other hand, is the work necessary to raise 1 lb. of the fluid from one energy level to another higher level. With incompressible liquid fluids, this work is equivalent to the difference in energy levels, expressed in feet of the liquid. When dealing with compressible fluids, the difference in energy levels is expressed somewhat differently and the difference between two energy or pressure levels in the case of uncooled centrifugal compressors is expressed as the Adiabatic Head H_a, which can be calculated from the formula:

$$H_a = 144\ (k/k-1)\ p_1 v_1\ (r^{(k-1)/k} - 1)$$

where k = constant for gas handled = c_p/c_v; c_p = specific heat at constant pressure; c_v = specific heat at constant volume; p_1 = initial gas pressure in psi. abs.; p_2 = discharge pressure in psi. abs.; v_1 = specific volume of gas at inlet conditions in cu. ft. per lb.; and r = desired ratio of compression = p_2/p_1. This formula applies, of course, only in so far as gases follow the perfect gas laws. However, its application provides an approximation which is perfectly satisfactory in most cases.

Because of the well known relationship $144\ pv = RT$, the formula for the adiabatic head can be further simplified into:

$$H_a = RT_1\ (k/k-1)\ (r^{(k-1)/k} - 1)$$

where T_1 = initial gas temperature in degrees F. abs. = (460 + deg. F.); and R = gas constant = 1,540 ÷ molecular weight. For air, with R = 53.34 and k = 1.3947,

$$H_a = 188.48\ T_1\ (r^{0.283} - 1) = 188.48\ T_1 Y$$

where $Y = (r^{0.283} - 1)$

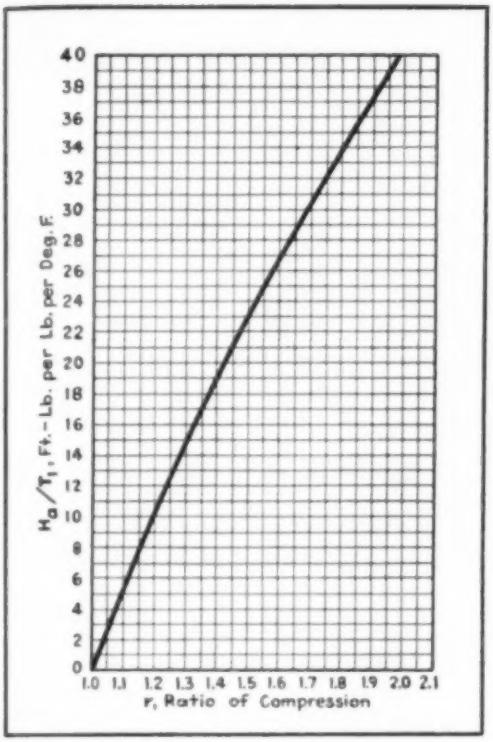
It should be noted that the value of k selected for air varies with different authorities, figures of 1.40 and 1.41 being frequently used. At the same time, it can be shown that it makes very little difference whether 1.3947, 1.40 or 1.41 is used. The increase of the term $(r^{(k-1)/k} - 1)$ due to an increase in the value of k is compensated by the reduction of the term $(k/k-1)$ in the low range of compression ratios encountered with centrifugal compressors. Thus, for example, let us assume a compression ratio of 2.0 and an inlet temperature of 60

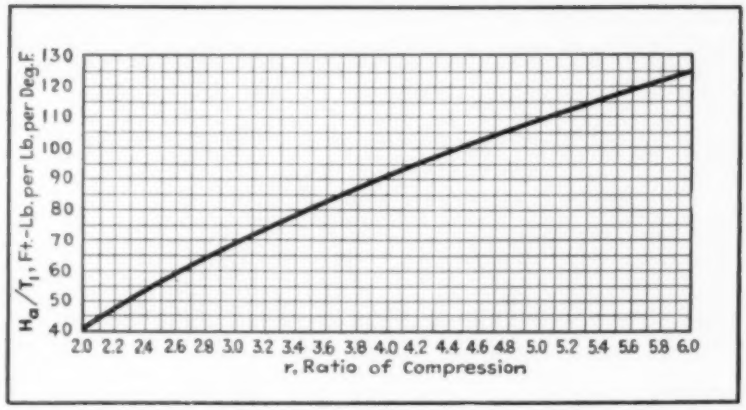
Table I—Properties of Gases, Averaged From Various Authorities
(Based on 60 deg. F. and 14.7 psi. abs.)

Gas	k, c_p/c_v	Sp. Gr., Air = 1	Mol Wt.	Density, Lb./Cu. Ft.
Acetylene	1.3	0.9073	26.0156	0.06880
Air	1.406	1.000	28.9752	0.07658
Ammonia	1.317	0.5963	17.0314	0.04509
Butane	1.11	2.067	58.078	0.15350
Butylene	.....	1.9353	56.0624	0.14826
Carbon dioxide	1.30	1.529	44.000	0.11637
Carbon monoxide	1.403	0.9672	28.000	0.07407
Carbureted water gas	1.35	0.4090	.....	.....
Chlorine	1.33	2.486	70.914	0.18750
Dichloromethane	1.18	3.005	84.9296	0.22450
Ethane	1.22	1.049	30.0468	0.07940
Ethyl chloride	1.13	2.365	64.4960	0.17058
Ethylene	1.22	0.9748	28.0312	0.07410
Flue gas	1.40	.....	.....	.....
Freon (F-12)	1.13	4.520	120.9140	0.31960
Helium	1.66	0.1381	4.002	0.01058
Hexane	1.08	2.7395	86.1092	0.22760
Hexylene	.....	2.9201	84.0936	0.22250
Hydrogen	1.41	0.06952	2.0156	0.00530
Iso-Butane	1.11	2.0176	58.078	0.15365
Iso-Pentane	.....	2.5035	72.0936	0.19063
Methane	1.316	0.5544	16.0312	0.04234
Methyl chloride	1.20	1.785	50.4804	0.13365
Natural gas* (app. avg.)	1.269	0.6655	19.463	0.05140
Nitrogen	1.41	0.9672	28.016	0.07429
Oxygen	1.398	1.105	32.000	0.08463
Pentane	1.06	2.471	72.0936	0.19055
Propane	1.15	1.562	44.0624	0.11645
Propylene	.....	1.4505	42.0468	0.11115
Refinery gas* (app. avg.)	1.20	.....	.....	.....
Sulphur dioxide	1.256	2.264	64.060	0.16945
Water vapor (steam)	1.33**	0.6217	18.0156	0.04761

* To obtain exact characteristics of natural gas and refinery gas, the exact constituents must be known.
** At 212 deg. F. All others are at 60 deg. F.

Republication rights reserved by author.

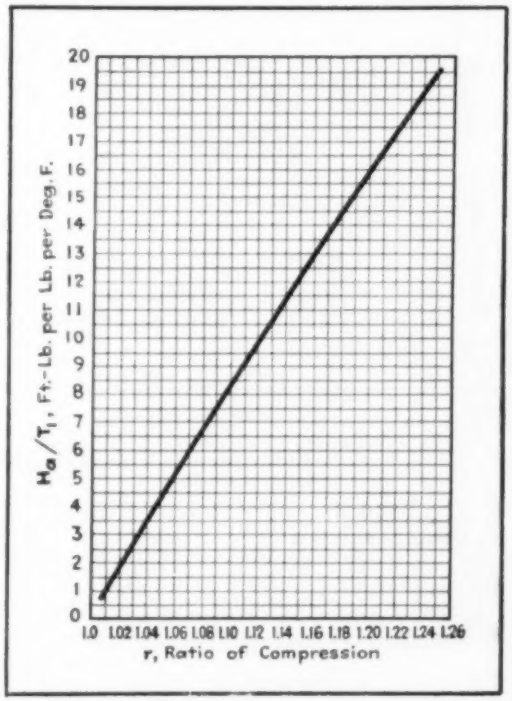




2 H_a/T_1 for air ($k = 1.3947$) for compression ratios from 2.0 to 6.0 ↑

1 H_a/T_1 for air ($k = 1.3947$) for compression ratios from 1.0 to 2.0 ←

Continuing the series of articles on centrifugal compressors which was started in our October 1947 issue, Mr. Karassik presents a group of charts which eliminate nearly all of the calculation ordinarily required in determining adiabatic head for air and perfect gases. Their use is made clear by the inclusion of examples covering air, steam and flue gas.



3 H_a/T_1 for steam ($k = 1.2973$) for compression ratios from 1.00 to 1.25

deg. F. When $k = 1.3947$, then $H_a = 21{,}238$. When $k = 1.30$, then $H_a = 20{,}858$, an error of 1.8 percent. Finally, when $k = 1.50$, then $H_a = 21{,}618$, also an error of 1.8 percent. It follows that since the correct value of k for air lies somewhere between 1.39 and 1.41, the maximum error may be of the order of 0.2 percent, or less than normal slide rule accuracy.

Because the majority of compressor applications deal with air, it was found advisable to include a tabulation of the values of Y, abstracted from a more extensive tabulation given in Engineering Computations for Air and Gases, by Sanford A. Moss and C. W. Smith (*Trans.* A.S.M.E., Dec. 1929). These data appear in Table II.

In addition, the value of H_a/T_1 has been plotted in **Figs.** 1 and 2 for compression ratios from 1.00 to 6.00, a range which will cover the majority of applications of centrifugal compressors for air handling. The use of these charts simplifies to a great extent the calculations required in the determination of adiabatic head, since it remains necessary only to multiply the value of H_a/T_1 corresponding to the desired compression ratio by the initial temperature in degrees F. absolute.

As a further example of the advantages derived from presenting the relationship of adiabatic head and compression ratio for various gases in the form of a precalculated chart, there is appended Fig. 3, which applies to the compression of steam over a range of compression ratios from 1.00 to 1.25. This chart is based on values of $R = 85.58$ and $k = 1.2973$.

In a later article a series of charts will be presented, suitable for the determination of the adiabatic head for any given gas, and corresponding to any compression ratio and any inlet temperature, once the specific gravity of the gas and its k constant are known. Starting with the relation:

$$\frac{H_a}{R\,T_1} = \left(\frac{k}{k-1}\right)(r^{(k-1)/k} - 1)$$

and substituting for R

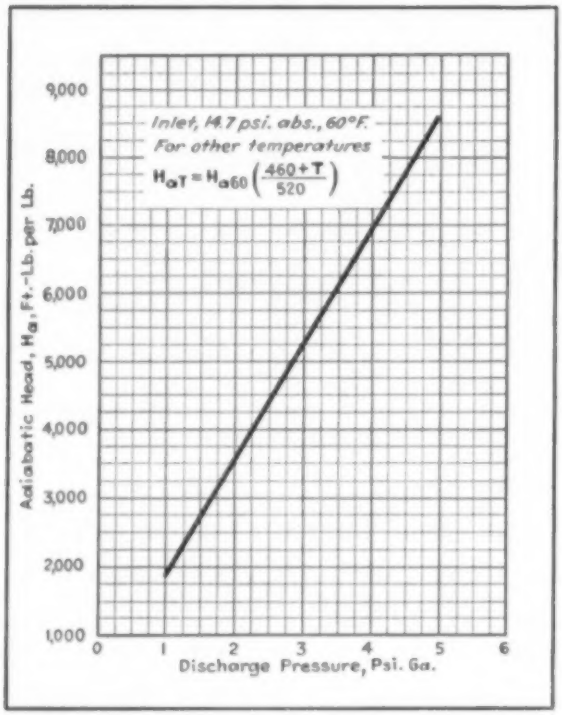
$$R = \frac{1{,}540}{\text{Mol. wt.}} = \frac{1{,}540}{\text{sp. gr.} \times 28.95}$$

we get:

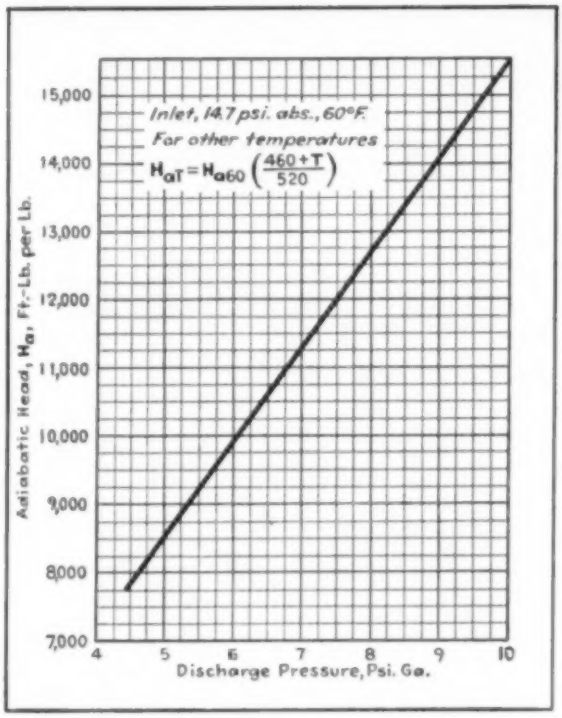
$$\frac{H_a}{T_1} \times \text{sp. gr.} = 53.34\,\frac{k}{k-1}\,(r^{(k-1)/k} - 1)$$

It will be this relation between $(H_a/T_1) \times$ specific gravity and the compression ratio r which will be represented on these charts for a variety of values of k.

Just as water is by far the most com-



4 H_a vs. discharge pressures from 0 to 5 psi. ga. for air at 14.7 psi. abs. and 60 deg. F. initial conditions



5 H_a vs. discharge pressures from 5 to 10 psi. ga. for air at 14.7 psi. abs. and 60 deg. F. initial conditions

Examples of Calculations of Adiabatic Head for Air, Steam and Flue Gas

EXAMPLE I

Conditions:	Gas	Air
	Inlet pressure	14.7 psi. abs.
	Inlet temperature	80°F.
	Discharge pressure	20 psi. ga.
Solution: (*a*)	Discharge pressure	14.7 + 20 = 34.7 psi. abs.
	Ratio of compression	$r = 34.7/14.7 = 2.36$
	H_a/T_1 (from Fig. 2)	52
	Inlet temperature	460 + 80 = 540°F. abs.
	Adiabatic head H_a	52 × 540 = 28,080 ft.
(*b*)	Check from Fig. 6	
	H_a at 60°F. inlet temp.	27,000 ft.
	H_a at 80°F.	$27{,}000 \times \left(\frac{460+80}{520}\right) = 28{,}080$

EXAMPLE II

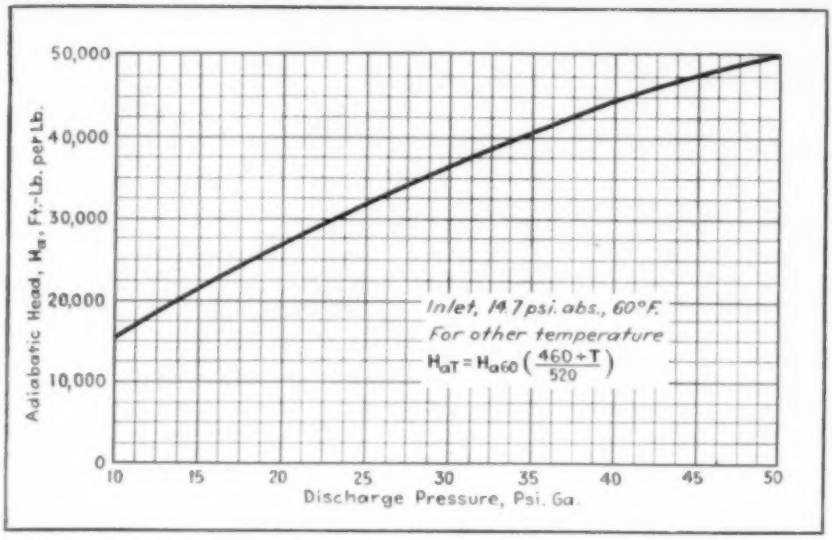
Conditions:	Gas	Air
	Inlet pressure	3 psi. ga.
	Inlet temperature	100°F.
	Discharge pressure	35 psi. ga.
Solution:	Inlet pressure	14.7 + 3.0 = 17.7 psi. abs.
	Discharge pressure	14.7 + 35 = 49.7 psi. abs.
	Ratio of compression	$r = 49.7/17.7 = 2.808$
	H_a/T_1 (from Fig. 2)	64
	Inlet temperature	460 + 100 = 560°F. abs.
	Adiabatic Head H_a	64 × 560 = 35,840 ft.

EXAMPLE III

Conditions:	Gas	Steam
	Inlet pressure	450 psi. ga.
	Inlet temperature	560°F.
	Discharge pressure	470 psi. ga.
Solution:	Inlet pressure	450 + 14.7 = 464.7 psi. abs.
	Discharge pressure	470 + 14.7 = 484.7 psi. abs.
	Ratio of compression	$r = 484.7/464.7 = 1.043$
	H_a/T_1 (from Fig. 3)	3.6
	Inlet temperature	460 + 560 = 1,020°F. abs.
	Adiabatic head H_a	3.6 × 1,020 = 3,672 ft.

EXAMPLE IV

Conditions:	Gas	Flue gas
	Molecular weight	31.0
	Inlet pressure	10-in. water column
	Inlet temperature	200°F.
	Discharge pressure	12 psi. ga.
Solution:	Inlet pressure	(10/12) (1/2.31) = 0.36 psi. ga. 14.7 + 0.36 = 15.06 psi. abs.
	Discharge pressure	14.7 + 12 = 26.7 psi. abs.
	Ratio of compression	$r = 26.7/15.06 = 1.77$
	Inlet temperature	460 + 200 = 660°F. abs.
	H_a/T_1 for air (from Fig. 1)	33.2
	H_a for air	33.2 × 660 = 21,900 ft.
	H_a for flue gas	21,900 × 28.95/31 = 20,450 ft.



6 H_a vs. discharge pressures from 10 to 50 psi. for air at 14.7 psi. abs., 60 deg. F.

mon liquid pumped by centrifugal pumps, air is the most common gas handled in compressor applications. As a result, practically all compressor ratings are referred to their air handling performance and to a standard set of suction conditions. These conditions may be (as noted in the first article) either 14.7 or 14.4 psi abs. inlet pressure and 60 deg. F. In order to simplify further the calculations necessary to determine the adiabatic head H_a corresponding to various discharge pressures, three curves have been prepared (Figs. 4, 5 and 6) to show H_a plotted directly against the discharge pressure in psi. ga., for a range between 1.0 and 50 psi. In all cases, the inlet pressure has been selected at 14.7 psi. abs. and the inlet temperature at 60 deg. F. To determine H_a when the inlet temperature differs from 60 deg. F., a correction is necessary, where:

$$H_a \text{ at } T°\text{F.} = H_a \text{ at } 60°\text{ F.} \times \left(\frac{460 + T°\text{ F.}}{520}\right)$$

Despite the preponderance of compressors designed to handle air, there are a number of applications where the fluid handled is a gas such as flue gas, oxygen, nitrogen, carbon dioxide, carbon monoxide, etc. For most of these gases, the value of k is close enough to the value of k for air, the only difference residing in the molecular weight of the gas. It is possible in such cases to make use of the charts of Figs. 1 and 2, prepared for air, provided a correction is applied to take care of the molecular weight difference by means of the formula:

$$H_{a\ gas} = H_{a\ air} \times (28.95/\text{mol wt. gas})$$

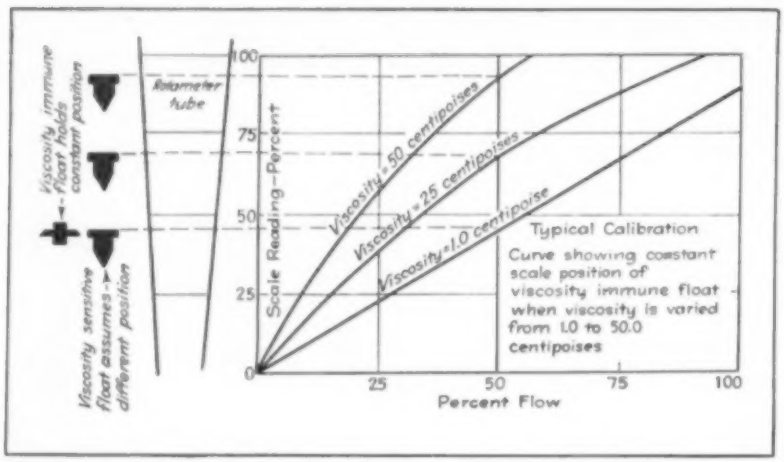
where 28.95 = molecular weight of air.

For convenience in calculations, constants for various gases, including molecular weights, adiabatic exponent k, specific gravity relative to air, and at 60 deg. F. and 14.7 psi. abs. are given above in Table I. which appears on page 132.

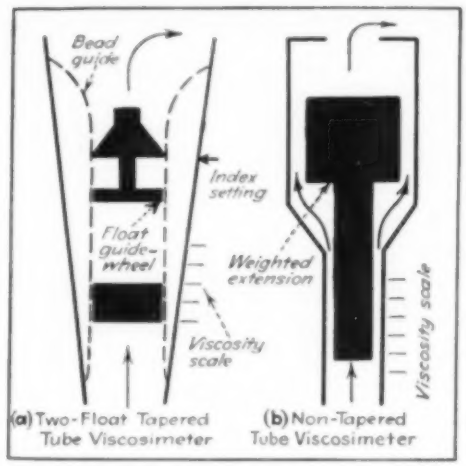
Table II—Values of Y for Normal Air and Perfect Diatomic Gases*

r	Y	r	Y	r	Y	r	Y	r	Y	r	Y	r	Y
1.00	0.00000	1.40	0.07990	1.80	0.18098	2.20	0.24999	2.60	0.31050	3.0	0.3647	7.0	0.7345
1.01	0.00282	1.41	0.10212	1.81	0.18283	2.21	0.25159	2.61	0.31193	3.1	0.3774	7.1	0.7414
1.02	0.00562	1.42	0.10433	1.82	0.18468	2.22	0.25319	2.62	0.31335	3.2	0.3898	7.2	0.7483
1.03	0.00840	1.43	0.10652	1.83	0.18652	2.23	0.25479	2.63	0.31476	3.3	0.4020	7.3	0.7552
1.04	0.01116	1.44	0.10871	1.84	0.18835	2.24	0.25638	2.64	0.31618	3.4	0.4139	7.4	0.7620
1.05	0.01390	1.45	0.11088	1.85	0.19017	2.25	0.25796	2.65	0.31759	3.5	0.4255	7.5	0.7687
1.06	0.01663	1.46	0.11304	1.86	0.19199	2.26	0.25954	2.66	0.31899	3.6	0.4369	7.6	0.7753
1.07	0.01933	1.47	0.11520	1.87	0.19380	2.27	0.26112	2.67	0.32039	3.7	0.4481	7.7	0.7819
1.08	0.02202	1.48	0.11734	1.88	0.19560	2.28	0.26269	2.68	0.32179	3.8	0.4591	7.8	0.7884
1.09	0.02469	1.49	0.11947	1.89	0.19740	2.29	0.26425	2.69	0.32318	3.9	0.4698	7.9	0.7949
1.10	0.02734	1.50	0.12159	1.90	0.19919	2.30	0.26581	2.70	0.32457	4.0	0.4804	8.0	0.8013
1.11	0.02997	1.51	0.12370	1.91	0.20097	2.31	0.26737	2.71	0.32596	4.1	0.4908	8.1	0.8076
1.12	0.03259	1.52	0.12580	1.92	0.20275	2.32	0.26892	2.72	0.32734	4.2	0.5010	8.2	0.8139
1.13	0.03519	1.53	0.12789	1.93	0.20452	2.33	0.27046	2.73	0.32872	4.3	0.5110	8.3	0.8201
1.14	0.03778	1.54	0.12997	1.94	0.20628	2.34	0.27200	2.74	0.33010	4.4	0.5209	8.4	0.8263
1.15	0.04035	1.55	0.13205	1.95	0.20804	2.35	0.27354	2.75	0.33147	4.5	0.5306	8.5	0.8324
1.16	0.04290	1.56	0.13411	1.96	0.20979	2.36	0.27507	2.76	0.33284	4.6	0.5401	8.6	0.8385
1.17	0.04543	1.57	0.13616	1.97	0.21153	2.37	0.27660	2.77	0.33420	4.7	0.5495	8.7	0.8445
1.18	0.04796	1.58	0.13820	1.98	0.21327	2.38	0.27812	2.78	0.33556	4.8	0.5588	8.8	0.8505
1.19	0.05046	1.59	0.14024	1.99	0.21500	2.39	0.27964	2.79	0.33692	4.9	0.5679	8.9	0.8564
1.20	0.05295	1.60	0.14226	2.00	0.21672	2.40	0.28115	2.80	0.33828	5.0	0.5769	9.0	0.8623
1.21	0.05543	1.61	0.14428	2.01	0.21844	2.41	0.28266	2.81	0.33963	5.1	0.5858	9.1	0.8681
1.22	0.05789	1.62	0.14628	2.02	0.22015	2.42	0.28416	2.82	0.34097	5.2	0.5945	9.2	0.8739
1.23	0.06034	1.63	0.14828	2.03	0.22186	2.43	0.28566	2.83	0.34232	5.3	0.6031	9.3	0.8797
1.24	0.06277	1.64	0.15027	2.04	0.22356	2.44	0.28716	2.84	0.34366	5.4	0.6116	9.4	0.8854
1.25	0.06519	1.65	0.15225	2.05	0.22525	2.45	0.28865	2.85	0.34500	5.5	0.6200	9.5	0.8910
1.26	0.06759	1.66	0.15423	2.06	0.22694	2.46	0.29013	2.86	0.34633	5.6	0.6283	9.6	0.8966
1.27	0.06998	1.67	0.15619	2.07	0.22863	2.47	0.29162	2.87	0.34766	5.7	0.6365	9.7	0.9022
1.28	0.07236	1.68	0.15814	2.08	0.23030	2.48	0.29309	2.88	0.34899	5.8	0.6446	9.8	0.9077
1.29	0.07472	1.69	0.16009	2.09	0.23197	2.49	0.29457	2.89	0.35031	5.9	0.6525	9.9	0.9132
1.30	0.07708	1.70	0.16203	2.10	0.23364	2.50	0.29604	2.90	0.35163	6.0	0.6604	10.0	0.9187
1.31	0.07941	1.71	0.16396	2.11	0.23530	2.51	0.29750	2.91	0.35295	6.1	0.6682	10.2	0.9295
1.32	0.08174	1.72	0.16588	2.12	0.23695	2.52	0.29896	2.92	0.35426	6.2	0.6759	10.4	0.9401
1.33	0.08405	1.73	0.16780	2.13	0.23860	2.53	0.30042	2.93	0.35557	6.3	0.6835	10.6	0.9506
1.34	0.08635	1.74	0.16970	2.14	0.24024	2.54	0.30187	2.94	0.35688	6.4	0.6910	10.8	0.9609
1.35	0.08864	1.75	0.17160	2.15	0.24188	2.55	0.30332	2.95	0.35819	6.5	0.6985	11.0	0.9711
1.36	0.09092	1.76	0.17349	2.16	0.24351	2.56	0.30476	2.96	0.35949	6.6	0.7058	11.2	0.9812
1.37	0.09318	1.77	0.17538	2.17	0.24514	2.57	0.30620	2.97	0.36079	6.7	0.7131	11.4	0.9912
1.38	0.09543	1.78	0.17725	2.18	0.24676	2.58	0.30764	2.98	0.36208	6.8	0.7203	11.6	1.0010
1.39	0.09767	1.79	0.17912	2.19	0.24838	2.59	0.30907	2.99	0.36337	6.9	0.7274	11.8	1.0107

* Abstracted from Moss and Smith, Engineering Computations for Air and Gases, *Trans. A.S.M.E.*, Dec. 1929. Original table gives one more decimal place in r and proportional parts for interpolation.



1 Viscosity-immune float is not affected by varying the viscosity (at constant flow) while the plumb-bob float moves 50 percent of scale



2 Two types of viscosimeters: (a) for ordinary values and (b) for high values

Continuous Viscosity Measurement

WILLIAM A. DIAMENT
Vice President, Fischer & Porter Co., Hatboro, Pa.

DIRECT READING, CONTINUOUS VISCOSIMETERS SHOULD INCREASE THE USEFULNESS OF VISCOSITY AS A PRECISE FLUID DIMENSION

Like many another phenomenon, viscosity is not widely understood. Relatively few appreciate that viscosity is a precise fluid dimension, as mathematically predictable and definable as molecular activity itself. Perhaps were viscosity measurements less arduous, time-consuming and more accurate, engineers would not so often be inclined to resort to methods and apparatus yielding relative rather than finite viscosity values. Difficulties of measurement have given rise to a dozen or more types of viscosimeters and a dozen or more viscosity units, few of which may be converted to the absolute centipoise system with cerfainty.

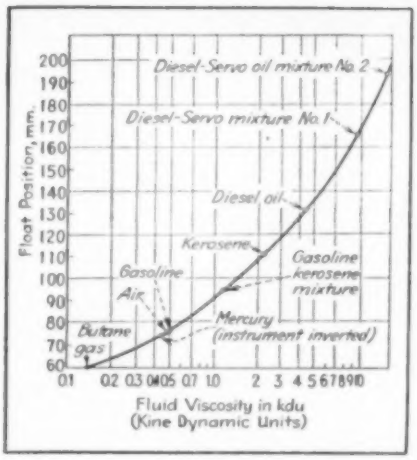
What is Viscosity?

Simply stated, viscosity is the stress required to produce a given rate of shear. For visual analysis, consider that any fluid (gas or liquid) behaves somewhat similarly to a deck of cards, each card representing a layer of liquid. The force required to cause the layers of fluid to slide one upon the other at a given velocity is directly proportional to the viscosity. New playing cards slide easily over one another, older ones with more difficulty; this being roughly comparable to low and high viscosity fluid behavior. For a study of the derivation and interchangeability of viscosity units refer to *Chem. & Met.*, Dec. 1945, p. 115.

All viscosimeters are designed to measure the forces involved in viscosity but many of them are complicated by the fact that absolute viscosity must be extracted from complexes involving also the variable inertial effects of fluids of different densities. In the course of ten years of hydraulic research into the behavior of thousands of different fluids in area type flow meters, an intensive study was given to the viscosities of these fluids as well as their other characteristics. Out of this research has sprung a new conception of viscosity measurement. This work led to the development of new metering element float shapes that were immune to effects of varying fluid viscosities. It was also found that the conventional plumb-bob float was sensitive to viscosity effects. Combining these two floats in series in a single fluid stream made possible the continuous measurement of viscosity.

In Fig. 1 will be found graphic representation of the comparative viscosity effects on the "Stabl-vis" (viscosity immune) type of float and the conventional plumb-bob type. While two separate series connected flowmeters each equipped with different float types can be used for viscosity measurements, only after perfection of the "Bead-guide" metering tube did it become practicable to incorporate both of the floats in a single instrument as illustrated in Fig. 2(a). This arrangement is referred to as the two-float type "Viscorator" (viscosimeter).

For several years, the two-float viscosimeter remained in relative obscurity because varied attempts at calibrating the viscosity scales in terms of popularly used units such as SSU and centistokes resulted in rather complex calculations to account for any appre-



3 New unit (KDU) simplifies calibration of continuous viscosimeter

ciable deviation from the calibrated density of the fluid. Thus, there remained one more step, to make the instrument entirely universal in handling fluids of many specific gravities.

New Viscosity Unit

It had been previously found that the kinematic behavior of any given fluid, (liquid or gas) flowing through a given rotameter tube and float combination is exactly the same as any other fluid if the value of the constant K calculated for each is equal. The expression for this constant is:

$$K = \sqrt{\frac{(\rho_f - \rho_w)\ \rho_w}{\mu_w}}$$

where ρ_f is specific gravity of the float material, ρ_w the specific gravity of the flowing fluid and μ_w the absolute viscosity of the flowing fluid. This fact soon formed the basis of an accurate laboratory technique for simulating the hydraulic characteristics of the most noxious and corrosive fluids to be handled by the instruments in actual service. In a word, it became possible to calculate the viscosity-density relationship required of a given laboratory fluid to simulate any field service hydraulic requirement, and thus obtain wholly dependable laboratory flow calibrations. The dimensionless constant K, which was first called "K-measure," has actually turned out to be a new and unusually flexible viscosity unit, *KDU* (Kine Dynamic Unit).

Both floats of the two-float viscosimeter are constructed of identical material (such as #303 stainless steel) and each instrument is calibrated with the viscosity immune float held at a single index point, the viscosity sensitive float registering *KDU*. With an instrument calibrated in *KDU*, centipoise values are obtained simply by setting up the observed scale value in the equation as follows:

$$\text{Centipoises} = K\,D\,U\sqrt{\frac{\rho_w\ (7.92 - \rho_w)}{6.92}}$$

This expression is based on an instrument calibrated in terms of a fluid having a specific gravity equal to 1.0. The viscosities of fluids of other specific gravities flowing through the viscosimeter may be measured by simply substituting the known fluid specific gravity in the formula and solving for centipoises. Centipoise values divided by the fluid specific gravity yields centistokes. The versatility of an instrument calibrated in *KDU* may be seen by reference to Fig. 3. Viscosities of gases were obtained from this instrument as simply as those for liquid mercury. Since mercury has a higher density than stainless steel (the float material), it is necessary to invert the instrument so that the mercury flows downward.

Index flow rates for various viscosity ranges in the two-float viscosimeter vary from 0.05 cu.ft. per min. for gases or 0.2 gal. per min. for liquids up to 10 gal. per min. with the higher index flow rates being required for higher viscosity ranges. The highest practical viscosity range for the two-float viscosimeter is approximately 225 centipoises (approximately 1,000 SSU).

Measuring High Viscosities

For high viscosities from 200 to 800,000 centipoises, it is necessary to resort to another type of measurement element which operates on a similar principle and retains all of the simplicity of the two-float type. Referring to Fig. 2(b), it will be seen that the metering unit of the so-called cylindro-plunger Viscorator consists of a precision-bore non-tapered tube and a cylindrical rod type float equipped with an upper weighted extension. The fluid is fed into the lower connection. It passes upward between the rod and the tube and thence past the upper weighted extension and on out the top connection. Feed is maintained constant by a positive displacement gear-type pump, driven at constant speed. The dimensions of the straight-bore tube and cylindrical plunger float are selected of such size as to insure laminar (viscous) flow at all times. As the fluid fed by the displacement pump passes up through the instrument, the cylindrical float moves to a position in the tube at which the viscous drag exerted on the exposed area of the cylinder equals the weight of the float. As the viscosity increases or decreases, and the viscous drag exerted on the plunger varies, the plunger tends to seek a higher or lower position in the tube. The height of the plunger in the straight-bore tube is a direct measure of viscosity.

Sampling Rate

The sampling flow rate, provided by displacement pumps, through these viscosity measuring elements may be within the limits of 6 to 600 cc. per min., depending on individual requirements. Whatever rate of feed is selected must be maintained constant, but if the rate changes by virtue of wear on the displacement pump, a simple and accurate correction may be made. The correction formula is as follows: Actual viscosity μ_a = (indicated viscosity, μ_i) (flow rate actual, Q_i/flow rate specified, Q_s). For example: A cylindro-plunger instrument supplied with viscosity scale based on a feed rate of 250 cc. per min. and actually used in service with a rate of 200 cc. per min. may be corrected as follows: Actual true viscosity = (scale viscosity) (250/200).

This mathematical simplicity permits the use of standby feed pumps without regard for exact interchangeability of discharge rates. If pump discharge rates are expected to vary as a result of wear on the pumps, the standby pump can be installed at intervals and appropriate corrections made to the flow scale depending on the calibrated volumetric capacity of the pump in use. This permits calibration of the pumps in the laboratory and eliminates the need for laborious adjustment of pump speed to arrive at a predetermined output.

Even with an accurate viscosity measuring device providing instantaneous readings such as the two viscosimeters described in this article, the values obtained are of little value without concurrent temperature information. While there are some scattered applications in which close knowledge or control of temperature is not essential for most applications this variable must be carefully controlled. Sometimes this is not an easy problem. In controlling viscosity, the temperature at which the viscosimeter operates must be controlled to within close temperature limits, and the selection of heat exchangers, temperature controllers, and the piping layout must be made with great care. Generally, for recording viscosity, a temperature recorder will be satisfactory; the most convenient arrangement being combined viscosity and temperature recorders so that the operator may study his viscosity-temperature relations from a single chart.

What to Look for at the C

SO FAR AS IT CAN BE DONE NOW, THE EDITORS HAVE ATTEMPTED HERE TO INTERPRET TRENDS THAT WILL BE EVIDENT AT THE SHOW

When the 21st Exposition of Chemical Industries opens its doors at the Grand Central Palace in New York on December 1, the occasion will be the first really postwar edition of this classic New York event. The 20th Exposition, in February 1946 was still much affected by wartime shortages. It might be expected, therefore, that many startling new developments would be found at the current Exposition. Unfortunately, such is not the case if present information from exhibitors is indicative. As we go to press, of course, this information is not complete.

Many manufacturers have informed us that they will be unable to show new developments because, in their present over-sold condition, they have not had time to make new equipment ready for the market. This, of course, has not prevented many improvements in design from being brought out, and it is also true that a comparatively small number of innovations of fundamental character will be on display.

Look for the Trends

A certain few trends are definitely in evidence, some of which are noted here, and some in the equipment sections below. For example, the trend toward continuous processing is clearly accelerating. There is a definite trend toward more severe process conditions involving more corrosive reactions, higher temperatures and pressures, and greater reaction speeds. The trend toward automatic operation has made further progress, demanding more and more in the way of automatic machinery, industrial instrumentation and apparatus for automatic analysis. Fluidizing as a means of promoting and improving reactions involving solids is definitely on the increase, while deionization has made marked inroads into the water treatment field as a substitute for distillation, and has also made a fair start in the purification of a few solutions.

A number of other trends should also be noted. High vacuum processing in the micron pressure range is making important gains in many types of process. The most striking and versatile device yet developed by the materials handling equipment industry—the fork truck—is appearing in a large number of special adaptations for particular purposes and bids fair to go farther. In grinding there is evidently a trend toward finer disintegration, down into the fine micron sizes, demanding better machinery and improved separation equipment. Plant housekeeping seems to be improving, which results in greater emphasis on dust collectors of better efficiency.

The preview given here is complete only to the extent that show exhibitors were able to provide us with information before press time. Replies were received from about half of the exhibitors, who were asked to supply us with information regarding the features of their exhibits, particularly those devices displayed which were new since the February 1946 show. They were asked to deal only with plant scale equipment, construction materials, instruments for process control, and packaging equipment, shipping containers and supplies.

Allowing for duplications in the list, the 21st Show will number in the neighborhood of 350 exhibitors, completely filling all available space at the Grand Central Palace.

Fluids Handling

Pipe and Fittings—A count of all exhibitors indicates that about 26 will devote their exhibits to pipe, fittings and valves. The Alloy Tube Division of Carpenter Steel Co. will show stainless steel pipe, tubing, fittings, flexible hose and finned tubes. Alloy valves and fittings, as well as precision castings in various ferrous and non-ferrous metals will be exhibited by the Cooper Alloy Foundry Co., which plans to feature its new Schumacher process composite match-plate pattern equipment for precision casting. A versatile new valve combining the features of both gate and globe valves, and designed for high corrosion resistance, will be shown by the Crane Company. The valve employs a plug-type gate. Other chemical industry valves, and the company's pressure-seal-bonnet type valves will also be shown.

Seamless Globeiron pipe will be fea-

Interior views from the 1946 Exposition

CHEMICAL SHOW

EDITORIAL STAFF PREVIEW

tured by Globe Steel Tubes Co., in the same exhibit with stainless tubing, seamless mechanical tubing, seamless boiler tubes, pressure tubes, and other tubular equipment. The new seamless iron pipe is expected to be particularly advantageous in the fields of building and construction, plumbing and heating, transportation and power. The Ladish Co. expect to feature a new line of seamless reducing ells as well as new stainless steel welding fittings. The Parker Appliance Co.'s newest contribution will be the flareless Ferulok type of tube fittings in which tubing is made fast in a coupling by means of a special ferrule that digs into the tube to make a tight seal. Many other tubing fittings and valves, together with tube fabricating equipment, will be shown by this exhibitor.

Trent Tube Manufacturing Co., a new exhibitor at the Chemical Show, plans to build its exhibit around stainless and Inconel tubing ranging in diameter from ⅛ to 22 in. and in wall thicknesses of 0.172 in. and thinner, down to 0.004 in. wall.

Fluid handling specialties at the show include the Barco Manufacturing Co.'s ball, swivel and revolving joints and a recently developed line of automatic air and water bag connectors for tire curing equipment. Black, Sivalls & Bryson, Inc., will again lay emphasis on this company's safety heads, pressure-vacuum vent valves, and air or gas-driven chemical feeders. The Garlock Packing Co. will exhibit a complete line of mechanical packings and gasket materials, as well as Klozure oil seals for anti-friction bearings.

Pumps and Compressors—A chemical pump designed for corrosive as well as severely abrasive conditions is the most recent development to be shown by Allis-Chalmers Mfg. Co. This concern also will exhibit automatic self-priming pumps. Ampco Metal, Inc., plans to lay emphasis on a new aluminum bronze centrifugal pump for process use, as well as other corrosion-resistant fabricated assemblies and non-sparking tools. The LaBour Co.'s packingless self-priming centrifugal pump will be the most important feature of its exhibit, demonstrating how its principle permits higher operating speed and therefore a smaller pump for the same capacity.

Among the manufacturers showing proportioning pumps, Proportioneers, Inc., intends to demonstrate several types, including pumps for very small continuous feed rates, closely controlled "shot" pumps, and a master control system combining a master controller, a loss-in-weight scale, a differential controller, and a group of proportioning pumps for small quantity additives. A new triplex feeder with all plastic diaphragm metering heads will also be shown. A novel development in the proportioning pump field is a new controlled volume pump known as the Constametric, to be shown by Milton Roy Co. This pump employs two plungers and is fully adjustable from a maximum to practically zero, yet makes use of a system of motion giving a constant forward speed to the plungers and thus delivers liquid at a constant rate, rather than with the pulsations usual in plunger pumps. The novel gearless pumps made by the Eco Engineering Co. will be shown in a line of corrosion-resisting alloys. Ingersoll-Rand Co. plans to exhibit a number of recent compressor developments.

Pursuit of "Nothing"

High Vacuum Equipment—With extremely high vacuum becoming an engineering necessity in many processes, high vacuum pumping equipment, instruments and applications will be shown by some six of the exhibitors. Among these, Kinney Manufacturing Co. will demonstrate compound and single stage mechanical high-vacuum pumps and a new type of vacuum-tight valve employing a stainless steel bellows, which is unaffected by mercury vapor. Both Distillation Products, Inc., and National Research Corp. will exhibit their high vacuum diffusion pumps and vacuum instruments, while the F. J. Stokes Machine Co. will introduce a new "packaged" high-vacuum pump for removing large volumes of air at high vacuum. This combines a standard Stokes mechanical high-vacuum pump with a diffusion pump. The unit is complete with control panel and switches, oil clarifier,

and high vacuum gages for both the fore-pump pressure and the high vacuum pressure.

Instruments and Control

Industrial Control Devices—The entire group of instruments and control mechanisms to be exhibited at the show is most extensive, and includes exhibits of over 50 manufacturers. In the industrial control group, Allis-Chalmers Mfg. Co. plans to give a working demonstration of its recently announced direct-current positioning and indicating equipment. In addition to a potentiometer-pyrometer, a resistance thermometer, an oxygen recorder and analyzer, and an indicating telemeter, the Bailey Meter Co. will exhibit its new area meter which is electronically operated and provides for particularly easy installation in a pipeline. A feature of the instruments to be shown by this company is the fact that they are all composed of eight standardized component parts which are interchangeable and are capable of combining in a great number of different ways. In the field of temperature controls will be those produced by the Burling Instrument Co., including this company's new Model L which functions on the basis of differential expansion of solids, and gives snap-action control.

The several new instruments exhibited by Fischer & Porter Co. will include an automatic ratio-controller, a new capacitance type flow alarm and a more compact continuous viscosimeter. The last mentioned instrument is suitable for viscosity values up to 800,000 centipoises. A new controller for minute flow rates is also to be exhibited, together with the company's older area type meters and controllers.

Emil Greiner Co. will exhibit a new industrial regulator for pressure and vacuum, said to maintain the pressure within 0.1 percent continuously, through a simple adaptation of the Cartesian diver principle. For level indication the Jerguson Gage & Valve Co. has developed many gage glass variations which are suitable for process use. Several kinds to be shown include heated and cooled types, special reflex gages for unusual applications, and gages for super-high pressures. A circular bulls-eye and a specialized sight-flow glass will be included.

A self-operating temperature controller known as Type T, for which exceptionally close control is claimed, will be shown by the Leslie Co. Mine Safety Appliances Co. will feature a new simplified colorimetric CO tester of high sensitivity, for low toxic concentrations of carbon monoxide, which requires no special training or skill for use. Electric level controls, photoelectric counters, electronic timers and a new combustion control system will be found in the booth of Photoswitch, Inc., the last named instrument giving full automatic control for oil and gas burners, to supervise automatically both the starting and the running conditions of the fire.

The exhibit of the Rubicon Co. includes several new instruments, among which will be a photoelectric galvanometer suitable for automatic control and recording applications, working at a small fraction of a microvolt. A new high sensitivity potentiometer, a general purpose photometer and an automatic recorder for hydrogen sulphide utilizing photometric measurements of the reflectance of an impregnated fabric tape exposed to the gas under analysis, will be supplemented by older colorimeters, galvanometers, bridges, and potentiometers. The Sarco Co., in addition to its regular line of steam traps and self-operated temperature regulators will exhibit a complete new line of electric motor valves for both on-and-off and proportional temperature and pressure control, this exhibit emphasizing what the company believes is a new trend in the direction of electrical operation of instruments. Schutte & Koerting Co. plans to exhibit several new styles of rotameters.

Automatic Analysis

Special Instruments—A great many instruments, formerly of interest primarily in the laboratory, have been moving into industrial use in recent years. Among these are instruments for automatic analysis, utilizing spectrometry of radiations in the visible, ultraviolet and infrared light ranges, X-radiations, and actual ionized particles as in the mass spectrometer. In addition, many other properties of matter are being used for analysis and quality control.

The American Instrument Co., in addition to its varied equipment for research in catalysis and super-pressures up to 100,000 psi., will exhibit certain new instruments, including an improved version of its electric hygrometer and a new water vapor indicator for giving fast, accurate determinations of water vapor in gases down to as small a concentration as 0.001 mg. per liter, or less. Baird Associates, Inc., will feature a continuous infrared analyzer, capable of indicating or recording the concentration of a single gas in a gaseous stream. In addition to its earlier developed pH meters and spectrophotometers, the National Technical Laboratories plans to exhibit an improved line-operated portable pH meter, a flame photometer accessory for its quartz spectrophotometer, and several types of radiation meters, the latter, of course, associated with the new interest in atomic energy and its applications.

Radiation detection is the function also of a compact new portable Geiger-counter radiation instrument to be exhibited by North American Philips Co. Another new development of this concern is a fluorescence analysis unit utilizing a new X-ray defraction technique for rapid quantitative metal and chemical analysis. A variety of photoelectric instruments for measuring color, fluorescence, reflection, gloss and similar variables, to be shown by Photovolt Corp., will be supplemented by a new pH meter for line operation, together with other equipment such as densitometers and process timers.

Its console-type electron microscope is to be the featured exhibit of the Radio Corp. of America, while its newest development to be shown is a high-vacuum gage covering the entire pressure range from atmospheric to 10^{-8} mm. Hg. This is accomplished by employing two sensitive elements, a thermocouple gage for the higher range, and a discharge (ionization) gage which cannot be damaged by over-pressure, for the lower range. In addition to a variety of laboratory apparatus including heating jackets, immersion heaters and liquid air containers in sizes up to 1,000 liters, Scientific Glass Apparatus Co. will exhibit spectrophotometers made by Coleman Industries, Inc.

Weighing Equipment—Continuous handling of a dry material will be demonstrated by a combination of equipment of Builders-Providence, Inc., and the Omega Machine Co. One of the latter concern's belt-type gravimetric feeders operated from a remote control station will be set up to feed to one of the new Conveyoflo dry-material meters recently developed by Builders. The Conveyoflo will also be tied in to the proportioning pumps in the exhibit of Proportioneers, Inc. This meter is of the belt-weighing type, but it uses diaphragms instead of a knife-edge scale for weighing the belt load.

Materials Handling

Some 15 manufacturers of materials handling equipment will exhibit at the Exposition. Exhibits will include a fair range of types and Show visitors will note a trend towards the use of hand-guided electric lift and fork trucks which has become evident in the past two years. A new small belt elevator, the Streamliner, Jr.,

will be shown by Harry J. Ferguson Co. This machine, 10 ft. long, is equipped with a hydraulic jack for raising or lowering the high end of the belt conveyor. The Fuller Co. will demonstrate pneumatic conveying equipment and its solids handling pump, together with associated and auxiliary equipment such as solids level indicators, feeders and solids coolers. Fork lift trucks for the 2,000 and 4,000 lb. ranges will be the featured exhibits of the Hyster Co., the new Model 40 for the higher range being a gasoline-powered, pneumatic-tired truck designed to go anywhere, on any surface, in any kind of weather.

Extending its line of vibrating equipment, the Jeffrey Manufacturing Co. plans to demonstrate a new dust-type vibrator, in addition to its earlier developments in vibrating coolers, dryers, feeders and barrel packers. Vibrating equipment will also be shown by the Syntron Co., the line including feeders, weigh feeders, packers, screens and elevators. The last named equipment is new, involving a new method of elevating bulk materials up a spiral flight by means of vibration.

Among the materials handling developments exhibited by Sprout, Waldron & Co. is the Pneu-Vac pneumatic conveyor which operates under reduced pressure and is said to require 25 to 50 percent less power than present pneumatic systems. No filter collector is necessary, it is claimed, and exhaust losses are said to be reduced by as much as 10 percent.

Indicative of the many variations that have recently taken place in the design of hand-guided, electric-operated lift trucks is the new tilting-fork Worksaver, shown by Yale & Towne Mfg. Co. Crates, pallet loads and skid-supported loads can be hoisted as high as 58 in. from the floor for stacking or loading over tail gates. Depending upon the length of the load, the machine can handle up to 1½ tons.

Materials of Construction

An extensive group of exhibits, numbering at least 35 companies and numerous subsidiaries, will be concentrated on this phase of chemical engineering interest. Included here are not only manufacturers of unfabricated metals, alloys and non-metallic construction materials, but also those making certain classes of equipment fabricated from special corrosion-resisting materials. For example, the use of Teflon, the new du Pont temperature and corrosion resisting plastic, will be featured by Alloy Steel Products Co. in seats and packing for corrosion resisting valves. This concern will exhibit a Hastelloy D gate valve which has been machined, in spite of the fact that this alloy has been considered unmachineable. Corning Glass Works will show, in addition to its laboratory glassware, numerous kinds and sizes of industrial glassware, including pipes, valves and fittings. The Duriron Co. will exhibit its corrosion-resisting pumps, valves, heat exchangers, fans, pipes and fittings, including new developments such as a Durco-Hills-McCanna valve, the new Type 2000 and 3000 plug valves, new Duriron heat exchangers and a Model 50 Durcopump. A new alloy, Chlorimet, is available in two types for resistance to hydrochloric acid and chlorine under various conditions, including boiling and oxidizing.

For Severe Service

The exhibit of Electro Chemical Supply & Engineering Co. will include acidproof stoneware for floors, linings and towers, as well as acidproof cements. General Ceramics & Steatite Corp. expects to exhibit a wide variety of chemical stoneware and porcelainware, including new large diameter porcelain towers, larger than could heretofore be made, and a new design of flanged porcelain tower. Haveg Corp. will feature its new "all-resin" grade 48 Haveg as well as fabricated and pressed molded articles of phenolic grade 41 and furane grade 60 Haveg resin materials.

Coating materials for corrosion resistance will be emphasized in the exhibit of Heil Process Equipment Corp. No. 486 is a heat-cured coating for resistance to solvents and dilute or weak acids. This material is a hard phenolic type. No. 445, a vinyl-base coating to be applied in substantial thicknesses, is rubbery and tough and suitable for oxidizing and mineral acids as well as alkalis. This material is being used for lining drums which will also be exhibited.

Developments in lead as a protective material are to be shown by Knapp Mills, Inc., including a new method of homogeneous bonding of lead to steel by a flat pouring process, giving a cost comparable to sheet lead linings; new lead-covered copper tubing; and a leaded grease for open gearing and bearings. The homogeneous bonding process is said to reduce costs greatly, compared with earlier homogeneous linings. The covered copper tubing enables much higher steam pressures to be used than with ordinary lead pipe, while the new grease is said to produce an anti-corrosion, anti-wear coating on gear and bearing surfaces, which is self-renewing.

The exhibit of Maurice A. Knight, in addition to chemical stoneware equipment and samples of the company's Pyroflex construction, will include a new rubber-like lining material known as Sealon. Applications of this company's furane plastic, Permanite, will also be exhibited. A variety of lead equipment—lined, covered and all-lead—will be shown by Lead Lined Iron Pipe Co. Luzerne Rubber Co. plans to feature many sorts of hard-rubber equipment, including pipe and fittings from ¼ to 4 in. size, and numerous specialties. Lapp Insulator Co. will show an entirely new porcelain centrifugal pump, a new armored construction for its porcelain Y valves, and a variety of other chemical porcelain pipe, valves and fittings, as well as special shapes.

Clad metals will receive the emphasis in the Lukens Steel Co. booth. Cladding metals will include nickel, Inconel, and Monel, as well as a new stainless clad steel. The exhibit also features fabricated equipment, including steam platens and jacketed dryer rolls. Republic Steel Corp. plans to show the many uses of stainless steel, and to point particularly to their suitability in shipping containers for beverages and many chemical products. The exhibit of U. S. Stoneware Co. has been planned to demonstrate a broad line of stoneware and plastics. In addition to Tygon plastics, the new coating material, Tygoflex will be on display. This material is built up to considerable thicknesses for protecting irregularly shaped process equipment. A new plastic flooring tile will be shown, together with non-toxic plastic flexible tubing for handling pharmaceutical and food products.

Separation Operations

Separation encompasses a broad group of unit operations, and it is, therefore, not surprising that more than 65 manufacturers will have exhibits that fall somewhere in this general category.

Centrifugals—Fletcher Works, Inc., expects to feature a new 26-in. underdriven centrifugal, having a removable basket to facilitate unloading. Tolhurst Centrifugals Division of American Machine & Metals, Inc., is going to show a 26-in. suspended centrifugal with hydraulic drive, permitting any speed from 0 to 2,150 r.p.m. to be selected. A full-size centrifugal filter of the continuous type will be exhibited by Bird Machine Co., cut away to show the operating parts.

Filters—In filtration, a trend toward pressure leaf filters appears to be developing for many applications. A

quite recent development of Alsop Engineering Corp., its Sealed-Disk pressure filter which is made in several construction materials, will be shown by this concern, along with a variety of equipment for mixing, blending, dissolving, storage and processing. Bird Machine Co. will make the first showing of the Bird-Young continuous rotary vacuum filter, a high-capacity type, which permits countercurrent washing with separation of the wash liquor. Hercules Filter Corp., also an exponent of pressure leaf filters, will demonstrate a design for simplified cleaning and will emphasize the use of commercially iron- and calcium-free asbestos filter pads to avert losses in acid filtrations.

A large capacity pressure leaf filter, 48 in. in diameter and 8 ft. high, with a filtering area of over 500 sq. ft., will be the main exhibit of Niagara Filter Corp. This filter will have an automatic leaf-washing mechanism built into the filter cover to permit cleaning in less than 15 minutes, without opening the filter. Oliver United Filters, Inc., plans to show a full line of pressure and vacuum filters, and will make the first showing of the recently developed horizontal rotary filter which consists of a horizontal rotary table, with individual segments connected to an automatic valve for filtration and separation of wash liquors.

In the field of filter presses is a new chemical filter-press plate of Panelite, a plastic, to be shown by St. Regis Sales Corp. T. Shriver & Co. plans to exhibit an improved hydraulic closing device for all types of filter presses, and a new plastic filter press of lower cost than most corrosion resistant alloys, yet said to be more widely applicable. This concern will also demonstrate an inclosed pressure filter in which pressure is applied inside the leaves, the tank acting only as a receiver.

Eimco Corp. expects to feature its laboratory filter equipment, while Filtration Engineers, Inc., will exhibit pilot plant filters and will lay emphasis on a new line of synthetic filter fabrics.

Something New

Dust Collectors—An entirely new idea in mechanically cleaned dust collectors will be exhibited by the Pulverizing Machinery Co. The new Mikro-Collector makes use of a cylinder of hard-pressed wool felt with the dust-laden air introduced inside the cylinder. It is cleaned continuously by a hollow annular blow ring which hugs and flexes the bag while moving up and down its outer surface, driven by a chain and sprocket drive. The inner periphery of this ring carries a narrow slit through which an air jet is directed, blowing back through the filter surface counter to the main air flow, and thus continuously removing the accumulated dust and causing it to settle into a conical discharge hopper. Claude B. Schneible Co. will exhibit its Multi-Wash collectors, which are wet-type units with multiple separation stages, while the W. W. Sly Mfg. Co., expects to show a complete line of filter type collectors, including a new series of small sizes, with capacities up to 6,000 cfm. of air. There are six units in this small series, designed to give exceptionally large filter area in a small compact unit.

Screens—Eight manufacturers will show screening equipment and screen wire cloth. Among these, Newark Wire Cloth Co. will exhibit metallic filter cloths and screen cloths, together with its End-Shak testing sieve machine.

Magnetic and Electrostatic Separators—Permanent magnets for separation of ferrous contamination have gained a great deal of ground in recent years. Indicative of this trend will be a number of types to be shown by the Eriez Mfg. Co., including a new permanently magnetized pulley for conveying belts and a new magnetic pipeline trap. Two manufacturers are expected to exhibit electrostatic separation equipment.

Thickeners—Further developments in thickeners and similar equipment will be shown by three manufacturers. The Dorr Co. will exhibit a heavier thickener and hydroseparator, of much greater structural strength, with greater raking capacity on heavy and coarse materials such as phosphate rock. This concern will also show an improved clarifier-filter combination for biological waste treatment which is built in two units, rather than the four formerly used.

Distillation—Information on only one exhibit in the field of distillation is at present available. The Vacuum Engineering Division of National Research Corp. expects to show a new rotary high-vacuum still, designed for the close separation of high molecular-weight materials, for example plasticizers, oils, drugs, fine chemicals and petroleum products.

Drying—Including manufacturers of desiccants and equipment for gas drying, as well as dryers for solids, 12 manufacturers will be represented at the show. The Glengarry Machine Works will exhibit the "packaged" laboratory spray dryer designed by Research Equipment Engineers, Inc. This unit is complete with all necessary controls, indirect heating system and collection equipment. Spray drying appears to be increasing in its range of applications.

Among the several types of dryer in the booth of Proctor & Schwartz, Inc., will be a 20-tray dryer for moderate quantities of powdered materials which employs a new automatic door opener. The Hardinge Co. expects to feature glass models of a Ruggles-Coles rotary dryer, in addition to its Thermo-mills for combined drying and grinding. F. J. Stokes Machine Co. will have a new pilot plant unit for drying and flaking, consisting of a double-drum dryer with panel board and instrumentation for indicating and recording test data for the design of full scale equipment. The desiccant, Sorbeads, a bead form of silica gel, will be shown by Socony-Vacuum Oil Co. Similar to this concern's bead catalyst for aviation gasoline, these beads are being advanced as a regenerable air-drying agent for industrial use.

Packaging

Close to 25 manufacturers exhibiting at the show will feature equipment associated with packaging and shipping. For example, the first showing of the Brewer automatic pipetting machine for filling small quantities of liquids into ampoules or vials will be made by American Instrument Co. Economic Machinery Co. will show its World Turret Labeler for fully automatic continuous labeling. The unit is built in both single and twin models. Its new Thrifty Weigh will be the featured exhibit of Glengarry Machine Works. This is a net-weight, semi-automatic filling machine for any type of container from 1 to 10 in. in height. The machine can also be used for proportioning.

Exhibited by the Karl Kiefer Machine Co. is the Vari-Visco filler for liquids and semi-liquids, with a capacity range of about 30 to 1 and a speed range of about 20 to 1 on the same machine. The Lakso Co. expects to feature an improved tablet inspection machine in which tablets are spread on a belt, then automatically turned over for reverse side inspection. Several new fillers, including both fully automatic and semi-automatic types, will be shown by the MRM Co. The fully automatic machine covers the range from 1 oz. to 1 qt. containers, which is the capacity range for one of the semi-automatics. The other semi-automatic is designed for 1-gal. containers.

Bottle cleaning is the function of the recently developed Rota Cleaner to be shown by Pneumatic Scale Corp., Ltd., capable of cleaning new

glassware with 60 psi. air at the rate of 120 bottles per min. The St. Regis Sales Corp. will feature bag packing equipment and multi-wall paper valve bags. For the production of tablets prior to packaging, F. J. Stokes Machine Co. will show a new toggle-type tablet compressing machine. The Triangle Package Machinery Co. will feature, among several types of filling equipment, a small, redesigned auger powder packer, semi-automatic in character and suitable for up to 30 packages per min. Among other exhibits in the packaging field will be slack and tight barrels and kegs, to be shown by the Associated Cooperage Industries of America, Inc.; fiber drums for dry and semi-liquid products, exhibited by Carpenter Container Corp.; and new lightweight cylinders of alloy steel, stainless steel and aluminum, for gas shipment, displayed by the Pressed Steel Tank Co. Bemis Bro. Bag Co. will show a new waterproof, paper-lined laminated textile bag, designed for dried milk, but believed to be suitable for a variety of chemicals. Many other types of bags will also be shown.

Heat, Power, Power Transmission

Some eight exhibitors plan to show equipment for the production and transfer of process heat. Amersil Co. has a newly-developed electric immersion heater in 1- and 2-kw. sizes, produced with a fused-quartz shell and a Nichrome heating element. The unit is proof, of course, against all corrosives except HF and alkalis. National Radiator Co. will base its exhibit upon cast iron condensing and cooling sections for process use, emphasizing the important effect on heat transfer of internal fins and swirlers in such equipment. Ovens for the bonding of brake linings to brake shoes by means of a plastic are to be exhibited by Trent, Inc., together with a split-type heating jacket for all sorts of process equipment which has recently been developed for heating to temperatures as high as 1,000 deg. C. A variety of other ovens, primarily for laboratory use, will be shown by the Electric Hotpack Co.

Power Production and Use—Postwar precision-built, squirrel-cage motors of all-steel construction in both protective and totally inclosed types will be shown by the Reliance Electric & Engineering Co., together with this company's all-electric adjustable-speed drive for broad-range and stepless control of both acceleration and deceleration. A new electric speed indicator will be a feature of this exhibit. Also in the variable-speed group will be the demonstrations of Reeves Pulley Co., covering variable-speed equipment for both automatic and manual control, all based on the variable-cone-pulley type of construction.

Process Equipment

Disintegration Operations—Exhibiting crushing and grinding equipment, colloid mills and homogenizers, there will be some 14 displays at the Exposition. The Hardinge Co. will emphasize the feeding and control of grinding mills, applying an electronically controlled variable speed feeder, and an "Electric Ear" automatic mill feed control device. Premier Mill Corp. will exhibit its latest 3-in. belt-driven and 6- and 8-in. direct-coupled colloid mills. Its most recent Mikro-Pulverizers and Mikro-Atomizers for grinding in the range from coarse disintegration, down to the lowest possible micron sizes, and in capacities from 10 to 24,000 lb. per hr., will be shown by Pulverizing Machinery Co., while Raymond Pulverizer Div. of Combustion Engineering Co. also will emphasize super-fine grinding down to 5 or 10 microns. The latter concern will also demonstrate its roller mills and flash drying system of combined drying and grinding.

In the booth of Sprout, Waldron & Co. one exhibit will be an improved heavy-duty rotary knife cutter with variable speed compression feed rolls, designed for granulating sheet plastics.

Mixing—Approximately ten of the exhibits will be concerned largely with mixing of liquids, semi-solids, and solids. The Cowles Co. will feature a line of dissolvers and dispersers never before exhibited. Claimed to be low in power consumption, this equipment employs a special high-speed impeller said to give much more rapid action than conventional equipment. A new continuous mixer, to be shown by the Marco Co., handles mixtures ranging from liquids to doughs and is said to offer a means of converting batch processes to continuous operation. Its continuous Flomix pipeline mixer, as well as agitator drives and complete agitated tank equipment, will be exhibited by the New England Tank & Tower Co.

Mixing Equipment Co. will display a wide line of portable and laboratory mixers and accessories, as well as a 36-in. diameter disperser turbine with removable blades. Read Machinery Div. of Standard Stoker Co. expects to emphasize double-arm and ribbon-type mixers, as well as a vertical planetary type. These mixers cover the field of dry to plastic masses.

Presses—Three exhibitors of mechanical and hydraulic pressing equipment will be represented. Among the equipment shown will be the standard 10-ton laboratory press developed by Fred S. Carver, Inc.

De-ionizing—Four manufacturers of de-ionizing equipment will exhibit, including Barnstead Still & Sterilizer Co., the Dorr Co., Illinois Water Treatment Co., and the Permutit Co. All will feature new applications and new models for this rapidly expanding unit operation.

Fluidizing—Increasing interest in the fluidizing of solids for heat-treatment and reaction purposes will be evident from the prominence to be given to this subject in the display of the Dorr Co. This company's FluoSolids process applied to the roasting and calcining of ores and chemical compounds will be dealt with in detail.

Process Vessels—About six exhibits may be expected to center around the theme of process vessels. Artisan Metal Products Co. Inc., will emphasize continuous processing phases. S. Blickman, Inc., plans to feature construction details and fabricating methods for stainless steel and alloy processing equipment. One detail so featured will be round-corner construction for tanks and similar equipment.

Other Equipment

Safety and Fire Protection—An improved type of cartridge respirator for protection against light concentrations of acid gases and organic vapors is to be exhibited by Mine Safety Appliances Co., as well as new protective aprons and sleeves produced from a translucent flexible plastic, and using electronically-welded seams. Pioneer Rubber Co. expects to put on a practical demonstration of the non-slip features of its neopreme industrial rubber gloves. Willson Products, Inc., will exhibit safety equipment, respirators and welding accessories, as well as certain instruments and a new line of plastic eye protectors available in a variety of types and models.

Tools—Its new portable electric impact tool, a multi-purpose device which does everything from drilling, to applying and removing nuts and bolts, will be emphasized in the exhibit of Ingersoll-Rand Co., together with a variety of air tools such as a new light-weight jackhammer.

Other—Spray nozzles in both metallic and non-metallic materials, strainers and regulating valves will be featured by Monarch Manufacturing Works. The exhibit of Blaw-Know Co. will be centered about a variety of processes, the newest of which is the Colgate-Emery continuous fat splitting process.

THE PLANT NOTEBOOK

Theodore R. Olive, ASSOCIATE EDITOR

$50 CASH PRIZE FOR A GOOD IDEA!

Until further notice the editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. The winner each month will be announced in the issue of the next month: e.g., the November winner will be announced in December and his article published in January. Judges will be the editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable, in that case being paid for at applicable space rates.

Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are considered.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

OCTOBER WINNER

A $50 prize will be issued to

R. B. BENNETT
Engineer, Akron, Ohio

For an article describing an ingenious tool for dividing a line into any desired number of proportional parts, that has been judged the winner of our October contest.

This article will appear in our December issue. Watch for it!

September Contest Prize Winner

A GRADIENT-TEMPERATURE COOLANT STORAGE TANK FOR VARIABLE LOAD REFRIGERATION SYSTEMS

FRANK I. STANNARD
Akron, Ohio

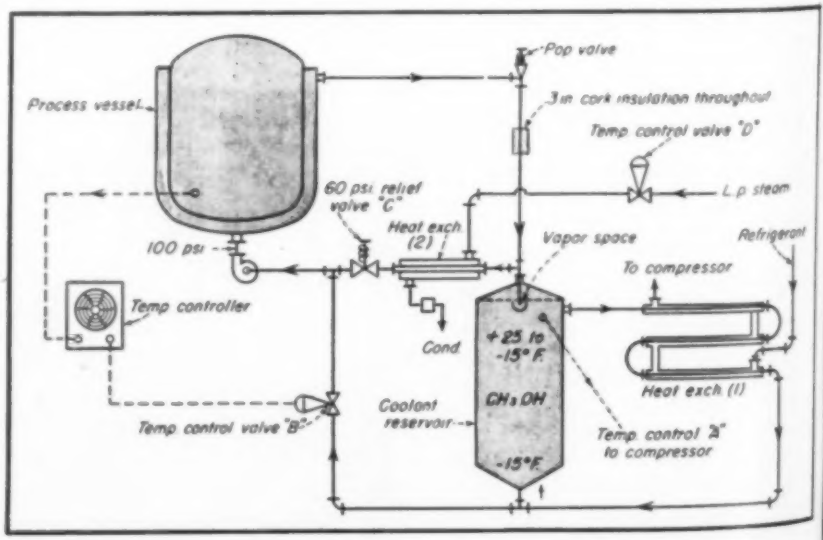
THE FLYWHEEL EFFECT produced by the use of a coolant storage tank in a refrigeration system greatly reduces both the initial and operating costs for such a system where there is a predominant peak load.

Most closed systems of this type include a tank for refrigerated coolant, and another for storing the coolant after it has been heated above the desired temperature. The system presented here is unique in that it takes advantage of the difference in specific gravity of the fresh and used coolant and stores it all in one tank. This tank may be approximately the same size as the refrigerated coolant storage tank for an equivalent system.

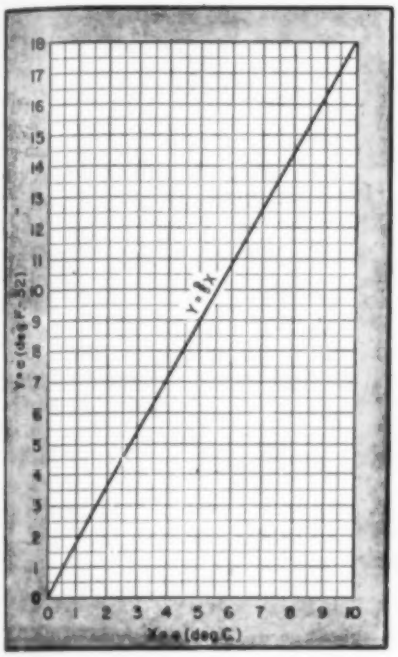
To start operation of the hook-up shown in the diagram, the compressor is run until the coolant in the reservoir reaches the desired temperature (say, −15 deg. F.). The warm coolant (for example, methanol) circulates through the heat interchanger (1) by specific gravity differential until the temperature controlled switch at A turns off the compressor. The reservoir is then full of −15 deg. F. coolant which, in conjunction with the compressor, is potentially able to carry away all of the heat produced in the jacketed autoclave and maintain the desired reaction temperature.

When the reaction starts in the autoclave, the temperature rises causing the control instrument to open valve *B*. The spring-loaded relief valve *C* causes the circulating pump to force coolant into the autoclave jacket. The warm coolant, in turn, is forced from the jacket to the top of the reservoir. The temperature switch at *A* then starts the compressor.

Should the reaction temperature in the autoclave drop below the control point, valve *B* would close and the methanol would recirculate through the spring-loaded relief valve and double-pipe steam heater (2). Valve *D* would open and introduce heat into the system through the heater.



Coolant storage system with single vessel for supply and return coolant



Through use of multiplier *a*, simple chart covers conversion of temperatures of any magnitude

TEMPERATURE CONVERSION AIDED BY DIAGRAM

BURTON H. SANDERS
Chemical Engineer,
Kew Gardens, L. I., N. Y.

ENGINEERS frequently need to make rapid conversions between units of temperature—from degrees C. to degrees F., or vice-versa. Although every handbook contains conversion tables, such tables are often not at hand or, if they are, still require time in finding the book, locating the page, and finally looking up the desired value. The method presented here, which is a graphical variation of the familiar conversion rule for these two sets of units, will be found a time saver after the user has acquired a little experience with it.

Where the Centigrade scale has 100 equal units between the freezing and boiling points of water, the Fahrenheit scale has 180 units. Unfortunately, Fahrenheit chose to call the freezing point 32 deg., so that 9/5 deg. C. = (deg. F. −32) and 5/9 (deg. F. −32) = deg. C. A straight line drawn on rectangular coordinates with a slope of 9/5 is then the graphical representation of the equation

$$Y = 9/5\,X$$

where Y = (deg. F. −32) and X = deg. C. However, unless a simple manipulation is used, a large chart would be required to cover a large range of temperature. A small chart of 18 units in height and 10 units in width can cover any temperature range if both X and Y are multiplied by a constant a, such that the temperature to be converted is within the range of the chart. The constant therefore varies with the problem and is chosen each time by inspection. Multiplying both sides of the equation by the same value a does not alter the value of the equation so that now we can consider that $Y = a$ (deg. F. −32) and that $X = a$ deg. C.

A chart of this equation can conveniently be drawn to large size for desk or wall use, but it can also be reproduced from memory at any time if a piece of graph paper is handy. Here are a few examples of its use:

Example 1—What is the deg. F. equivalent of 5 deg. C.? From the chart read $Y = 9$ at $X = 5$. Since $Y =$ (deg. F. −32), then deg. F. = 9 + 32 = 41.

Example 2—What is the deg. F. equivalent of 55 deg. C.? Choose a as 1/10, that is, multiply both X and Y by 1/10. Since $X = 5.5$, then from chart $Y = 9.9$. But $Y = 1/10$ (deg. F. −32) = 9.9 so deg. F. = (9.9 × 10) + 32 = 131. Or, a could have been chosen as 1/11, in which case X would have been 5 and Y would have been 9, with deg. F. = (9 × 11) + 32 = 131.

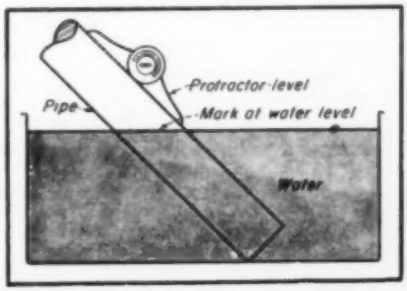
Example 3—What is the deg. C. equivalent of 257 deg. F.? Here $Y/a =$ (deg. F. −32) = 225. To avoid estimating small fractions, take a as 2/100 so that $Y = 4.5$, from which $X = 2.5$. Since $X = 2/100$ deg. C. = 2.5, then deg. C. = 2.5 × 50 = 125.

Example 4—What is the deg. F. equivalent of −12.5 deg. C.? Again to avoid estimating, take a as −2/10. Then $X = 2/10 \times -12.5 = 2.5$ and from the chart $Y = 4.5$. Hence deg. F. = −10/2 × 4.5 + 32 = 9.5.

SUBMERSION METHOD SIMPLIFIES MITER JOINT LAYOUT

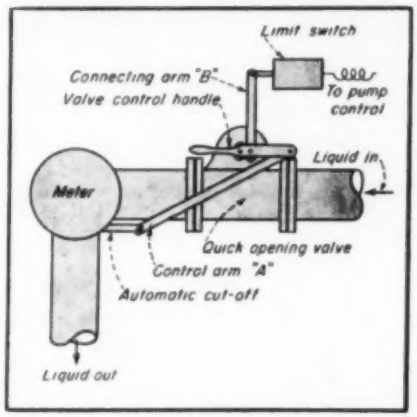
MYRON C. ZIEMKE
Oak Ridge, Tenn.

WELDERS may well take a tip from the tire shop where the mechanic locates leaks in an inner tube by submerging it in water. There is a difference, however, in that the welder is interested in intersecting the pipe with a plane at the proper angle for the bevel he must cut in making a miter joint of the desired angle. The level surface of water in a tank can provide that intersecting plane, with neatness and dispatch. Such a tank is a permanent installation in our shop, where an electric chain hoist is provided to lift the work and hold it at the desired angle, as indicated by a protractor-level held on the pipe. The arrangement is indicated in the accompanying sketch.



Water level can be used to mark a bevel for making miter joints

When the proper angle is established the work is lifted from the tank and the line left by the water is traced carefully with chalk or soapstone. After the bevel has been cut it is not necessary to repeat the process if additional pieces of the same diameter are to be cut to the same bevel. All that is necessary is to cut a template from light sheet metal, which can be made by wrapping the metal around the pipe and clipping it off to match the desired end. In the diagram the angle indicated is 45 deg. from which a 90-deg. joint will result if two pieces so beveled are properly welded.



Meter passes predetermined volume of liquid, then closes valve and stops pump

SEMI-AUTOMATIC METHOD FOR LIQUID METERING

W. S. SHAMBAN and J. KABORYCHA
U. S. Industrial Chemicals, Inc.
Newark, N. J.

A SIMPLE method of semi-automatic liquid metering has recently been developed at the Frelinghuysen Ave. resin plant of U. S. Industrial Chemicals, Inc., at Newark, N. J., which has proved to be very satisfactory after months of rigorous use. The advantage of this system is that both the liquid flow cut-off valve and the pump are closed simultaneously when the desired quantity of liquid has passed through the meter. This prevents the creation of high pressures in the lines and ac-

companying damage to equipment.

A predetermining quick-opening valve is placed in the line between the pump and the Pittsburgh Rotacycle bulk plant meter (which contains an automatic cut-off). This is indicated in the accompanying diagram. The automatic cut-off on the meter is connected to the control handle of the quick-opening valve by means of connecting arm A. Another connecting arm B is attached to the same control handle, close to the pivot point of the handle, and actuates a limit switch. The switch in turn operates the control switch of the pump motor. A push-button control for the pump is used for starting the pump and also for emergency stops.

To start the flow of liquid, it is only necessary to set the meter for the amount that is to be delivered, pull the control handle on the quick-opening valve and push the pump motor start button. When the required amount has passed through the meter, the automatic cut-off closes the quick-opening valve, and stops the pump. An emergency bypass containing a back-pressure valve is used with the pump as an added precaution in the event that the system does not work properly.

MEASURING FLOW RATE OF CORROSIVE SOLUTIONS

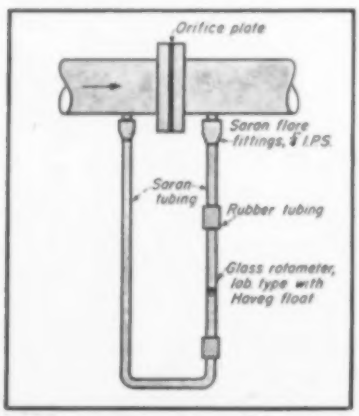
F. A. MITCHELL
Plant Engineer, Evans Chemetics, Inc.
Waterloo, N. Y.

IN CERTAIN plant operations it is necessary to measure fluid flow, for which we prefer to use rotameters. However, in our plant, it was necessary to measure velocities in rather large size pipe. Corrosion resisting rotameters for 3- or 4-in. pipe diameters are rather expensive and hard to get. An alternate was to use an orifice and a manometer. In order to keep the orifice losses as low as possible, a large diameter orifice was used. To measure the rather small differential in pressure, an organic liquid with a low specific gravity had to be used in the manometer.

This solved the technical problem, but introduced a problem of maintenance. Time and time again the operators would overrange the instrument, blowing out the indicating liquid. The solution that was metered contained a reducing chemical, which made it difficult to find a suitable dye to color the manometer fluid. Dirt in the manometer would frequently confuse the operator in his effort to secure a correct reading. Need for eliminating these problems led to the idea of using a small rotameter to measure the flow of liquid in the branch line connecting the up- and down-stream taps of the orifice.

There are available small glass rotameter tubes that use Haveg floats, which fit in nicely in the place of the old manometer. The sketch shows the application clearly. Saran fittings and tubing are used to connect up the rotameter. If the unit is mounted on a piece of plywood painted with a few coats of acid-resisting paint, it will have a neat appearance. A further refinement would be to cut out a narrow slit the length of the rotameter and then mount a suitable rotameter. This makes it easy for the operator to take the correct reading.

Some idea of the size of rotameter to use can be obtained by substituting the maximum pressure drop in the usual formula of $Q = A(2gh)^{1/2}$; where A = area of branch pipe, sq.ft.; h = manometer reading, ft. of water; and Q = flow, cu.ft. per sec.



Rotameter in orifice bypass meters flow in large liquid lines

CUTTING THERMOPLASTIC FILTER CLOTH

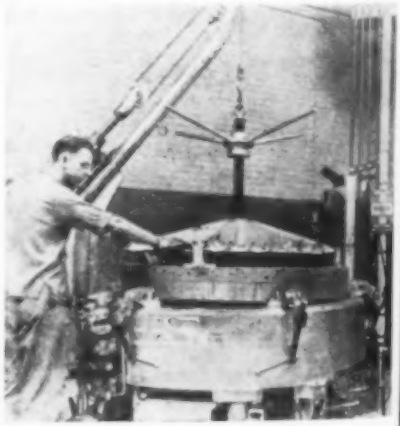
R. A. GHELARDI
Merck & Co., Philadelphia, Pa.

VINYON CLOTH when cut frays very easily due to the nature of the material. In many industrial applications this can be an annoyance. For instance: Vinyon filter press cloths will fray around the port holes cut in them and the fibers then either slough off and get into the piping system or protrude into the press channels, tending to obstruct the flow of fluid. In one instance Vinyon cloth had to be discontinued as a centrifuge liner because fibers were getting into the product.

This difficulty can be easily overcome by using heated tools to do the cutting and hole punching. Vinyon is thermoplastic, with a softening point about 65 deg. C. For cutting holes an ordinary arch punch of the proper size is heated to about 400-500 deg. F. It is then only necessary to press the punch lightly against the cloth at the proper spot. A slight twist and a disk is cut out. The edges of the hole are fused so that fraying is impossible. The heat effect does not extend more than 1/32 in. beyond the tool if the contact time is about 1 second. We have found that eight 1¼-in. holes can be cut in a cloth in this manner in less than 15 seconds. The cloth of course should be laid out flat, preferably on a wood surface.

For cutting cloth to length from a roll, a rolling disk is used. This tool is made from an old pipe cutting wheel. It is mounted on an axle to which a handle can be attached, very much like a paperhangers rolling cutter. The wheel does not have to be sharp, in fact a slight "flat" on the cutting edge is desirable. The tool melts its way through the cloth and a thick edge maintains its temperature far better than a thin, sharp edge.

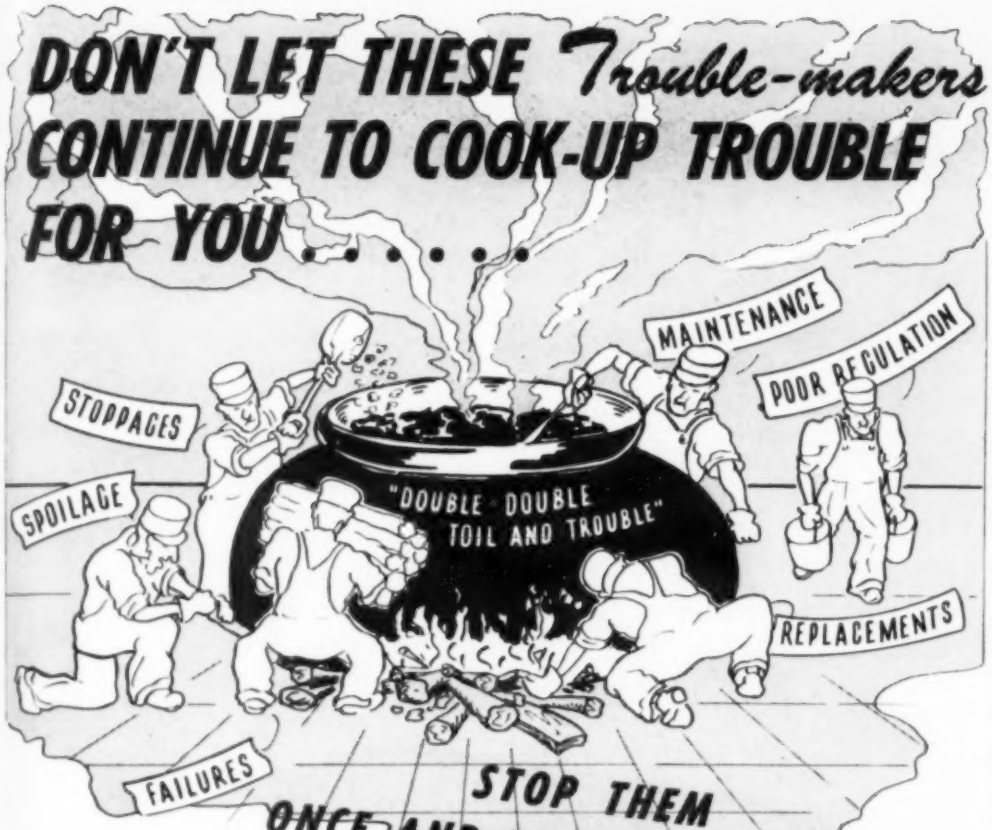
With a hot rolling cutter a Vinyon cloth can be cut as easily as with a razor. The cutter is rolled over the cloth against a guide using light pressure. The cut is clean and sharp and the edges fused. Since using this method of cutting Vinyon, fiber troubles have been eliminated. Saran can be handled similarly.



INSULATION FOR PROTECTION

INSULATION to avoid heat loss from live steam piping is a well known idea, but the use of insulation on condensate return lines, as a means of protection for personnel, is by no means so common. Industrial Mineral Wool Institute uncovered this application on a tire mold (marked by arrow), where a couple of extra lengths of formed mineral wool pipe insulation have been installed to shoulder height on the return line to prevent employee burns. The same idea is useful wherever close quarters make such burns possible.

DON'T LET THESE Trouble-makers CONTINUE TO COOK-UP TROUBLE FOR YOU . . . . . .



STOP THEM ONCE AND FOR ALL WITH THE CASH STANDARD Streamlined TYPE 1000 PRESSURE REDUCING VALVE

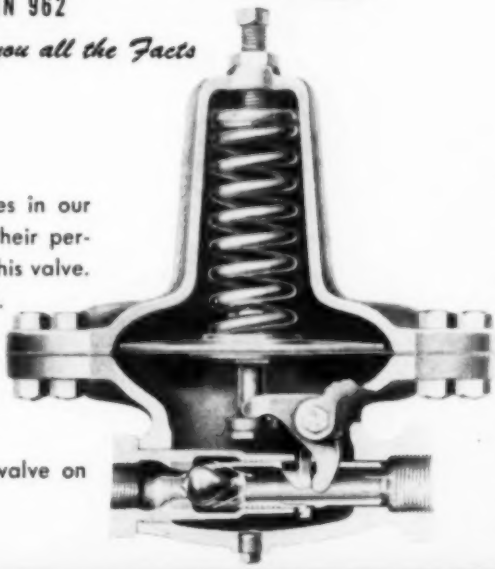
◀ BULLETIN 962
Gives you all the Facts

A USER SAYS:

"We have had many STREAMLINER Valves in our plant and I am more than pleased with their performance. Since 1938 when we first tried this valve, we have never purchased any other make.

"They are used on steam lines to our yeast tubs, on treating lines, on steam lines to the hot water heaters, and on steam lines in the laboratory.

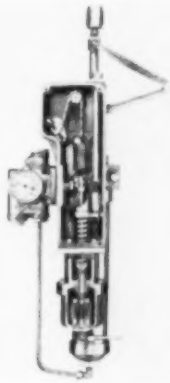
"In my opinion, this is the best reducing valve on the market."



CASH STANDARD CONTROLS . . . VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES
Send for them

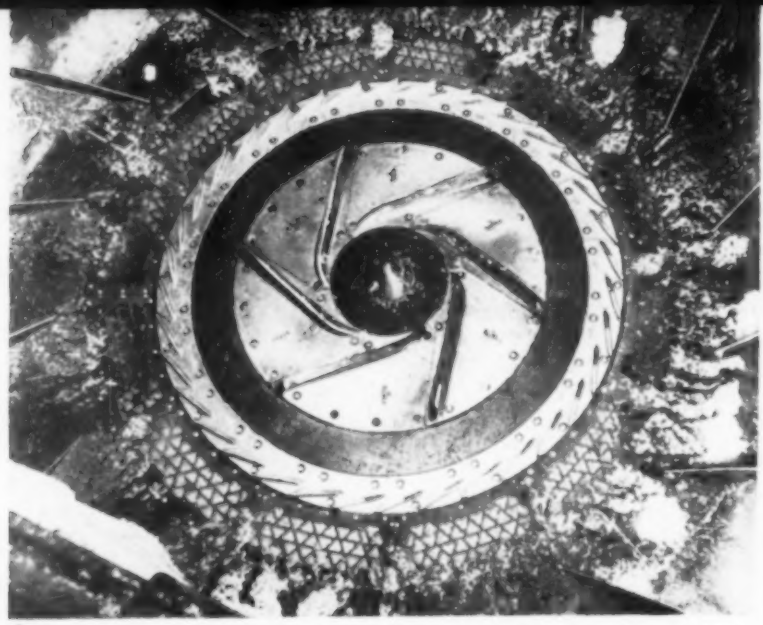


Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.

Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.

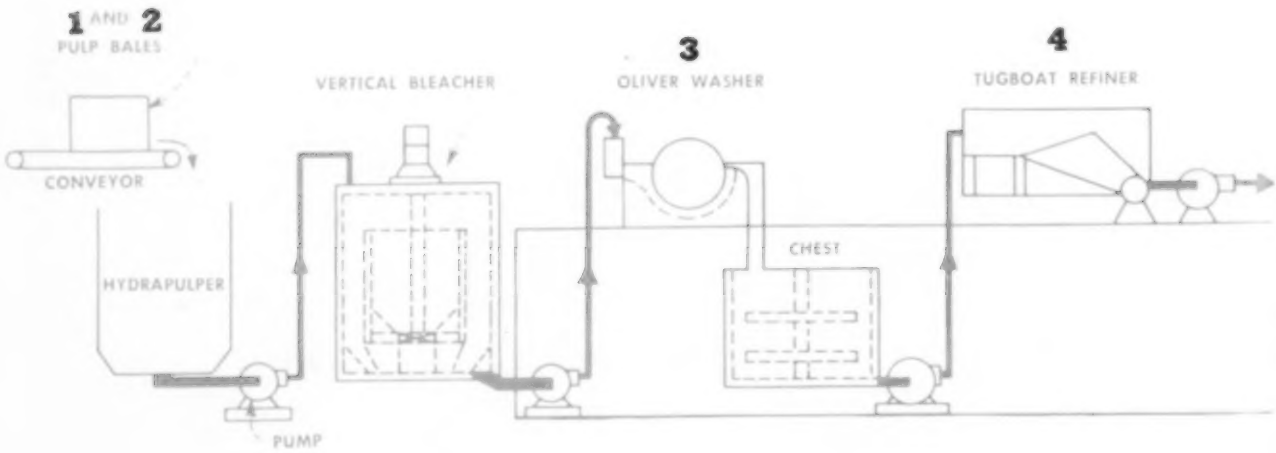
Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

1 First step in production of glassine is charging of pulp into a hydropulper



2 Paper fibers are quickly hydrated by the action of high-speed rotary blade in floor of the tank and fixed louvers on sloping wall

All photographs by William M. Rittase



GLASSINE PAPER

GLASSINE PAPER is produced at Milford, N. J., by the Riegel Paper Corp. Glassine is a thin, transparent paper. Sulphite pulp is conveyed to a hydrapulper where a high-speed rotary blade in the floor of the tank and fixed louvers on the sloping walls initiate the hydration. The pulp is pumped into a vertical bleacher and treated with calcium hypochlorite and caustic. Bleached stock is washed on an Oliver washer. The slush is further broken down in bleaching tugboats. The mass of wet pulp moves slowly about while the bleaching agent is being exhausted. A battery of Jordans gives the pulp a final refining. Severe beating treatment is provided by a Claflin which operates in series with the Jordans. While similar in appearance to the Jordan, the arrangement of knives and the more obtuse cone of the Claflin provide the beating required for glassine. From the Claflins the pulp goes through a Centrifiner and a screen.

Refined pulp is now ready for the resin which is added while the pulp is in the head box. A rotameter regulates the addition of the urea-formaldehyde resin, Uformite 470. Thoroughly hydrated and refined pulp is necessary for glassine production. The 1 percent slurry leaves the head box and flows out onto a moving fourdrinier wire of the wet end of the paper machine. The paper sheet, running through the machine, is impregnated with plasticizers for required degree of pliability and transparency. This step is employed only if plastic-treated glassine is desired. Glassine may be plain, wet strength, plastic-treated or waxed; often it is a combination of these. Reeling and rewinding operations take place at the end of the paper machine. Paper is redamped slightly and large rolls are cut down to standard size. Glassine may be waxed to assure impermeability to water vapor.

CHEMICAL ENGINEERING

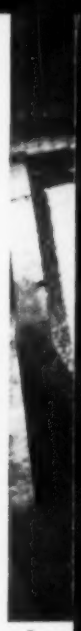
November, 1947

PAGES 148 TO 151

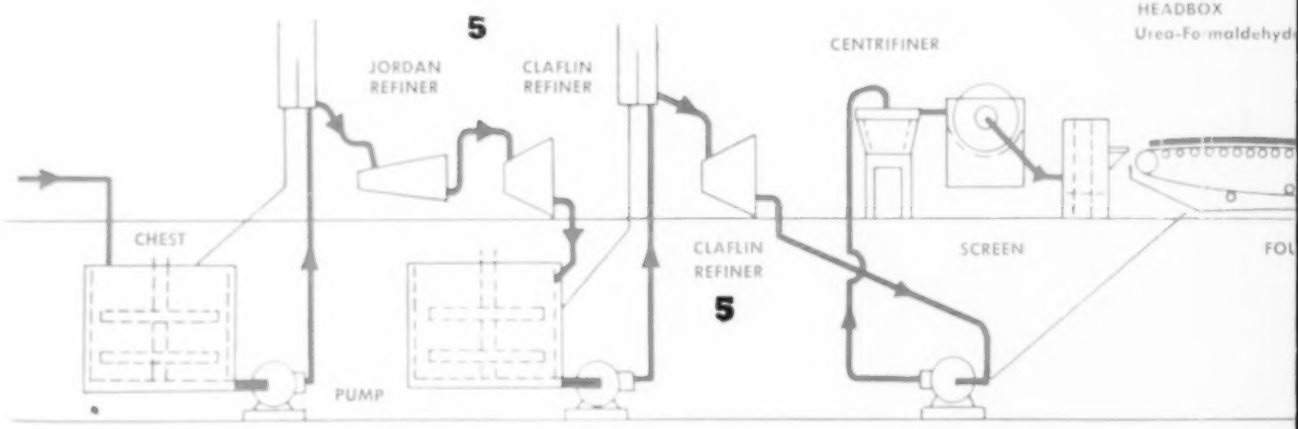
Chem & Met

PICTURED FLOWSHEET

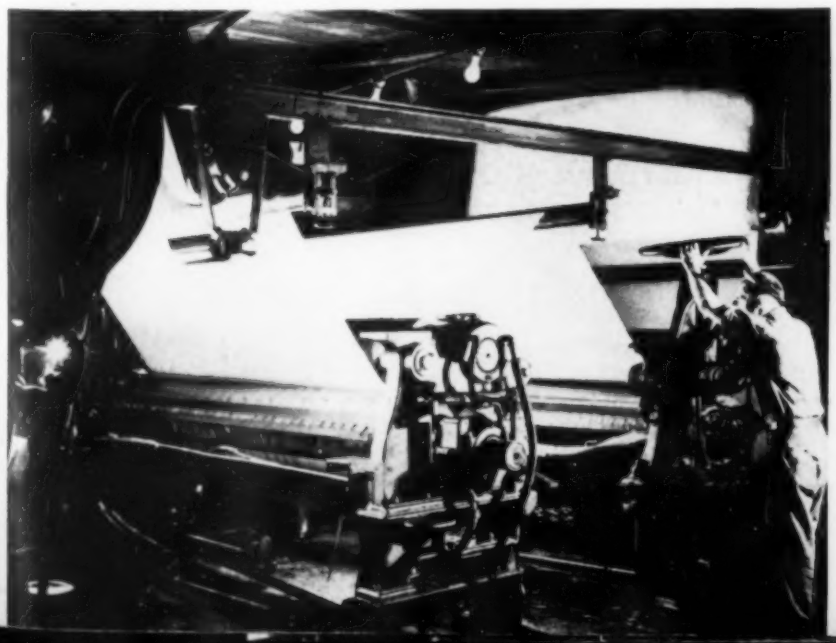
3 After pulp is hydrated and bleached it is pumped to a rotary vacuum washer where sprays of water remove bleach liquor and caustic solution



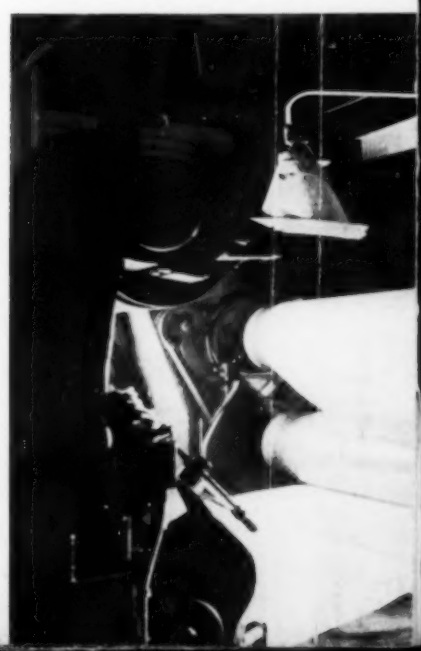
4 Sl... slowl...



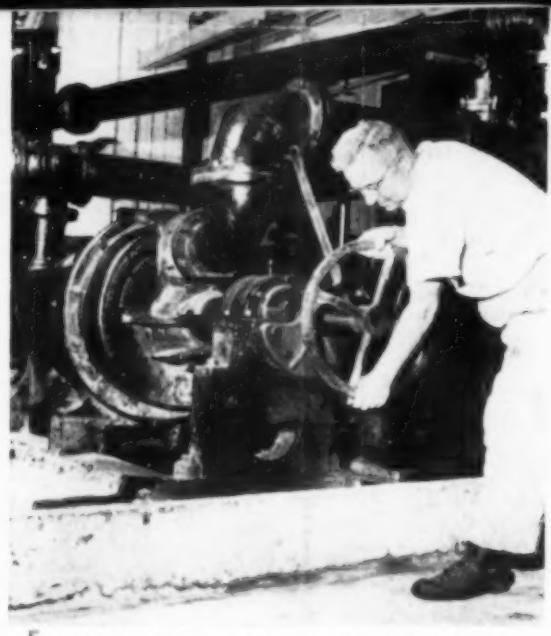
8 Sheet of paper passing through paper machine may be impregnated with plasticizers for required degree of pliability and transparency



9 Reeling and rewinding takes place redamped slightly and large rolls are

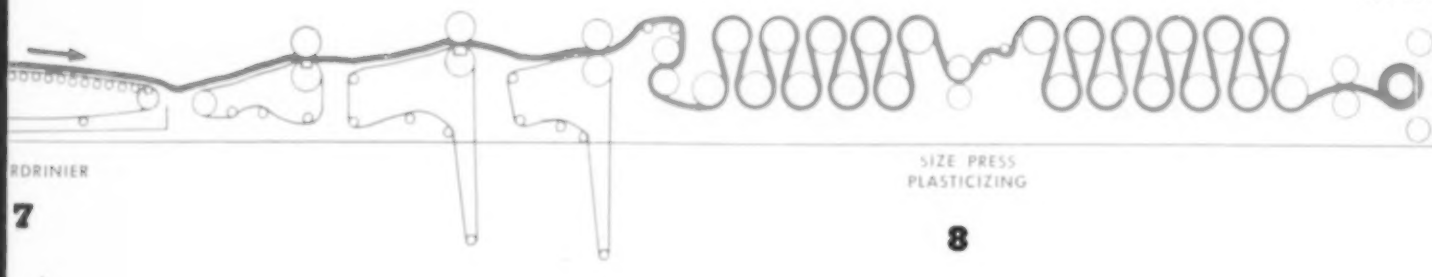


sh is further broken down in bleaching tugboats; mass of wet pulp moves about while bleaching agent is being exhausted by heat



5 Pulp is given a refining treatment in a battery of Jordans before going to Claflins

6



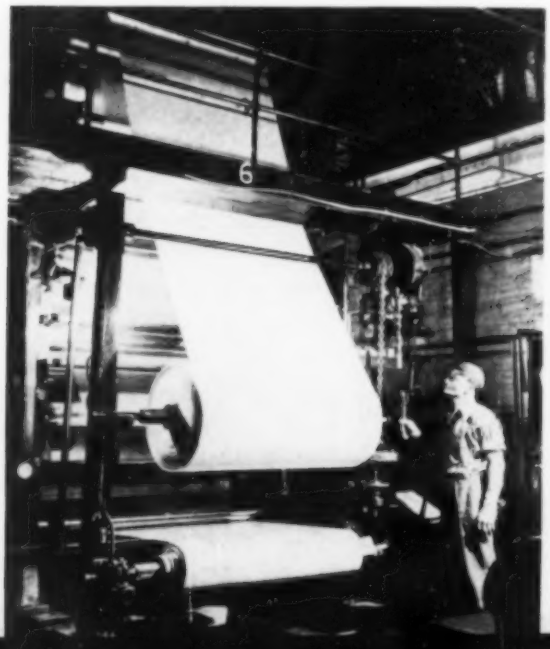
7

8

9

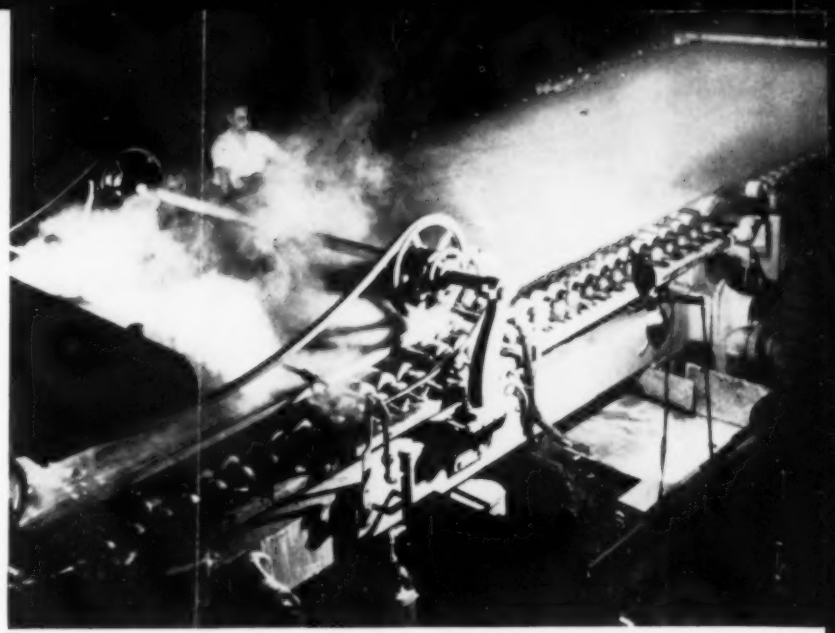
at end of paper machine. The paper is cut down to standard size

10 Pressure exerted by supercalendering improves transparency and grease proofness

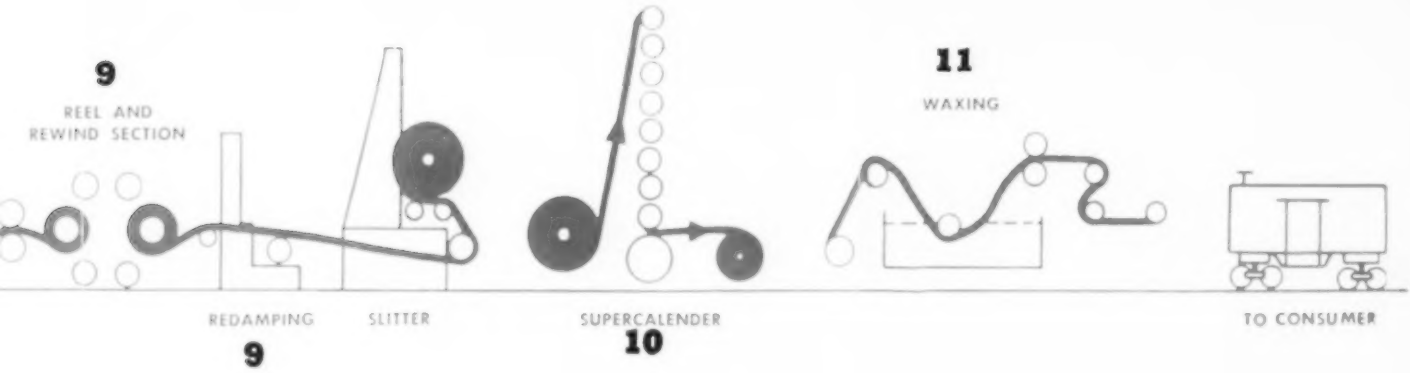


11 Molten wax may be deposite thickness regulated as coated sheet

6 Urea resin, Rohm & Haas Uformite 470, is added in head box to increase wet strength

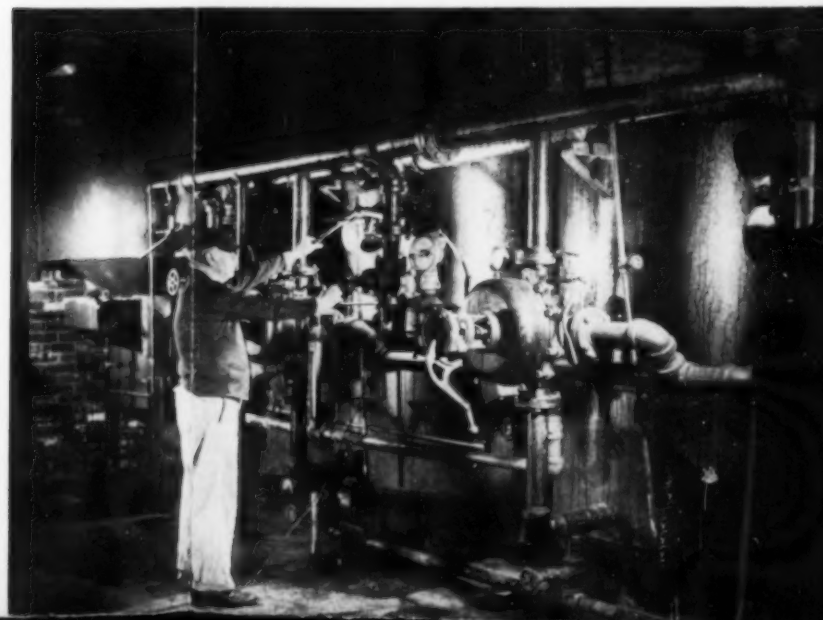


7 Low consistency stock (less than 1 percent fiber) leaves head box and flows onto moving fourdrinier wire screen of paper machine



be deposited on sheet as it passes through bath and its coated sheet passes between rolls

Eighty thousand gallons of softened water are delivered daily at Riegel plant by this installation of a synthetic ion exchange resin



Have you considered new uses for Carbon Disulfide—(Bisulfide)?

Many chemists and chemical engineers are finding that CS_2 offers a possible starting point for a wide variety of organic reactions. Because Carbon Disulfide is a low-cost basic material—and is obtainable as an extremely pure chemical—the appeal for new uses is particularly strong.

Baker's method of manufacturing Carbon Disulfide is unique. An unusual electro-thermic method is coupled with continuous rather than batch distillation. This further insures uniformity of the finished product.

By using this Baker method and exercising extreme care in the choice of raw material, Baker's Carbon Disulfide is unusually free from other sulfides (assaying 99.99%).

If you are in development work and contemplate the use of Carbon Disulfide as a basic raw, we invite correspondence against present and future needs.

We have increased plant facilities, and are now in a position to serve more customers well.

J. T. Baker Chemical Co., *Executive Offices and Plant:* Phillipsburg, N.J. *Branch Offices:* New York, Boston, Philadelphia and Chicago.

Baker's

Baker's Chemicals

C. P. ANALYZED • FINE • INDUSTRIAL

Baker's

Steam . . . water . . . oil . . . or gas
CRANE Supplies all Piping equipment

. . . A good thing to remember for a simplified piping job every time . . . on new or replacement installations. No matter what the fluid or working conditions, see the Crane line first for *all* piping equipment . . . and for dependable quality in every item.

For this water supply system, for example, the Crane Catalog puts everything at your finger tips . . . valves, fittings, pipe, and pipe line accessories. One order to your Crane Branch or Wholesaler covers all your needs. From design to erection to maintenance, your piping job moves fast and smooth . . . with good performance assured . . . because you get this 3-way advantage:

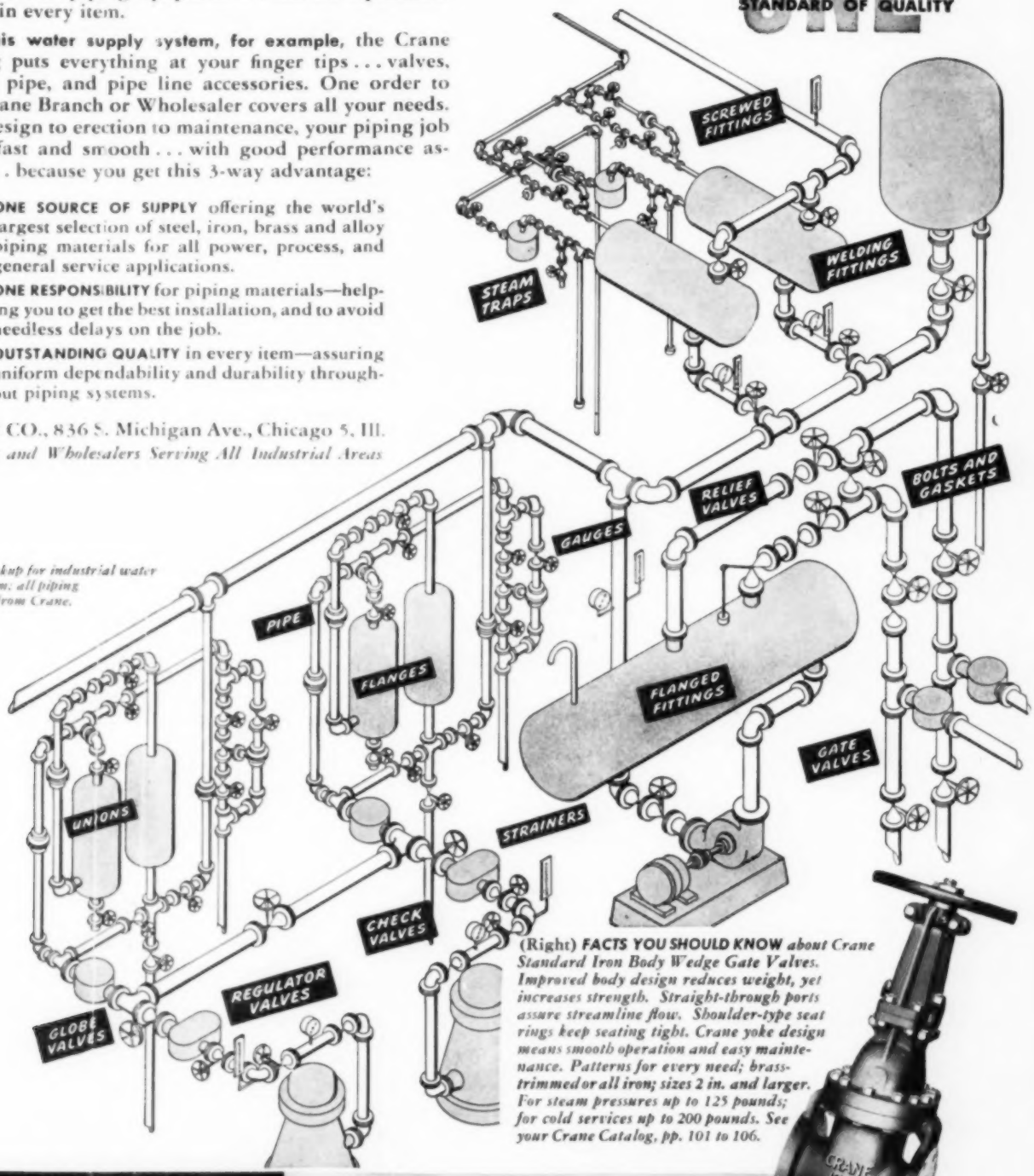
ONE SOURCE OF SUPPLY offering the world's largest selection of steel, iron, brass and alloy piping materials for all power, process, and general service applications.

ONE RESPONSIBILITY for piping materials—helping you to get the best installation, and to avoid needless delays on the job.

OUTSTANDING QUALITY in every item—assuring uniform dependability and durability throughout piping systems.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY



Typical hookup for industrial water supply system; all piping equipment from Crane.

(Right) **FACTS YOU SHOULD KNOW** *about Crane Standard Iron Body Wedge Gate Valves. Improved body design reduces weight, yet increases strength. Straight-through ports assure streamline flow. Shoulder-type seat rings keep seating tight. Crane yoke design means smooth operation and easy maintenance. Patterns for every need; brass-trimmed or all iron; sizes 2 in. and larger. For steam pressures up to 125 pounds; for cold services up to 200 pounds. See your Crane Catalog, pp. 101 to 106.*

EVERYTHING FROM . . .

CRANE

VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

FOR EVERY PIPING SYSTEM

RAYMOND BOOTH No. 67 CHEMICAL SHOW

60 Years' SERVICE to the CHEMICAL INDUSTRY

MECHANICAL AIR SEPARATOR

ROLLER MILL

RAYMOND PULVERIZING EQUIPMENT

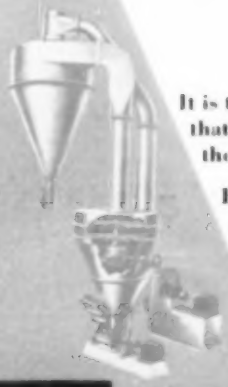
BOWL MILL

LABORATORY MILL

It is through constant research and development that Raymond machines have kept pace with the advances in the chemical pulverizing field.

Raymond offers a complete line of modern grinding mills in a capacity range from small Laboratory Units up to Super Roller Mills delivering forty tons per hour. Air separation provides close fineness control and uniform finished materials . . . in a range from 20-mesh through intermediate grades up to 400-mesh materials . . . with particle sizes 95% to 99% finer than 5 to 10 microns, as now achieved on the new Raymond Vertical Mill.

Whizzer-type Mechanical Air Separators, operating in closed circuit with Raymond Mills, are used in meeting specifications of specialty products. Flash Drying Systems with different types of Raymond Mills are available for drying and grinding in one operation.



AUTOMATIC PULVERIZER

IMP MILL

VERTICAL MILL

The breadth of Raymond engineering service will be found helpful in your pulverizing problems.

SINCE 1887

COMBUSTION ENGINEERING COMPANY, INC.

RAYMOND PULVERIZER DIVISION

1311 NORTH BRANCH STREET • CHICAGO 22, ILLINOIS

Sales Offices in Principal Cities

CANADA: COMBUSTION ENGINEERING CORP., LTD., MONTREAL

PROCESS EQUIPMENT NEWS

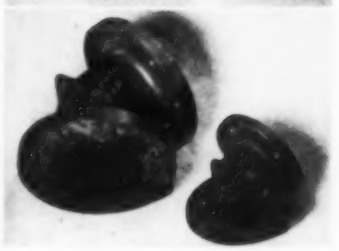
Theodore R. Olive, ASSOCIATE EDITOR

CONTENTS

Saran-Lined Pipe	155
Spray Safeguard	155
Mass Spectrometer	155
Hand-Automatic Valve	156
Cycle Controller	156
Indication Transmitter	156
Miniature Recorder	156
Vacuum Tablet Press	156
Differential Gage	158
General Utility Pump	158
High Temperature Insulant	158
Magnetic Separator	158
Viscometer Extension	158
Explosion-Proof Starter	158
Thickness Gage	160
Portable Belt Elevators	160
Air Diffuser	162
Safety Tile	162
Carboy Pump	164
Cylindrical Cooling Tower	164
Fork Side Shifter	166
Flammable Vapor Detector	166
Adjustable-Speed Motor	168
Laboratory Evaporator	170
Flexible Hose	170
Teflon Gasket	170
Roller Pipe Support	170

1. Saran-Lined Pipe

SARAN-LINED steel pipe and fittings, for corrosion resistance, are being introduced by the Dow Chemical Co., Midland, Mich., and will be fabricated by the company's plastics division at the Midland plant. The new pipe will offer the rigidity and pressure strength of steel, coupled with extreme resistance to a wide variety of chemicals, oils and solvents. It is said to be satisfactory for sulphuric, hydrochloric, nitric and phosphoric acids, with a working temperature ranging from zero to 190 deg. F., depending on service conditions. Sizes will be available from 1 to 4 in., with a maximum length of 10 ft. Available fittings will include elbows and tees,



companion and reducing flanges, and gaskets. Conventional tools and pipe fitting methods similar to those for steel pipe may be used in assembling such pipe, it is stated. Cost is claimed to compare favorably with other chemical pipe, with reductions contemplated as manufacturing procedures are improved.

2. Spray Safeguard

TO PROVIDE additional safety in the electrostatic paint spraying and detearing system described in our May 1945 issue, the Harper J. Ransburg Co., Indianapolis 7, Ind., has developed a new electronic "Spark-Guard" which automatically stops the equipment should a piece accidentally approach the discharge electrode, either from swinging, from falling, or from some other dislocation. With proper installation of the equipment it is claimed that there is very little likelihood of a spark occurring in normal operation, but the new "Spark-Guard" is said to add still further to the safety of the installation. This equipment consists essentially of a self-contained control cabinet, a power pack and electronic relays arranged to de-energize the electrostatic field when accidental dislocation of a part introduces a possible hazard. It is claimed that the electrostatic field will be de-energized before visible sparking can occur in about 95 percent of all cases and that in the other 5, the field will be de-energized with the occurrence of only a very small spark of extremely short duration.

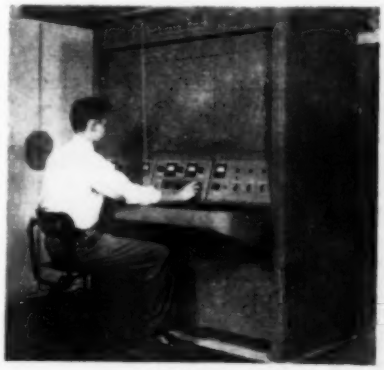
The equipment will be supplied to all present users of both Ransburg electrostatic spray and electrostatic detearing equipment and will be incorporated in all future installations.

FOR MORE INFORMATION

See Reader Service Coupon on pages 171–172

3. Mass Spectrometer

DEVELOPED primarily to assist in the study of tracer techniques using the rare stable isotopes in both industrial and biological research, a new instrument known as the Consolidated-Nier isotope-ratio mass spectrometer has been announced by Consolidated Engineering Corp., 620 North Lake Ave., Pasadena 4, Calif. The latest member of the mass spectrometer family built by this concern was developed from

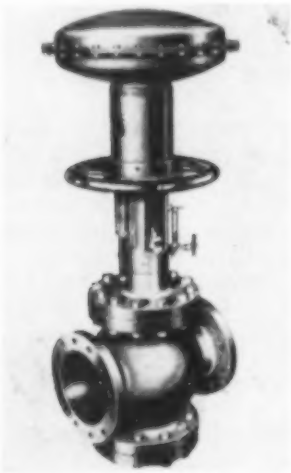


basic investigations of Dr. A. O. C. Nier of the University of Minnesota. The instrument sells for about one-third the price of the company's regular mass spectrometer and is intended to fill the need for an instrument more specialized in application and somewhat less sensitive in some ranges than the larger model. It has been designed primarily to determine the ratio of concentration of one isotope to another in a sample of gas, and this determination can be made in one rapid, direct-reading measurement. Only a

few minutes is required. The entire instrument is housed in a single metal cabinet providing ready access to all components. Its range of measurement extends from hydrogen-deuterium ratios to isotope ratios in gases having masses as high as about 70. Measurements are claimed to be reproducible from one time to another within a fraction of 1 percent of the ratio. Thus tracer materials are detectable after heavy dilution.

4. Hand-Automatic Valve

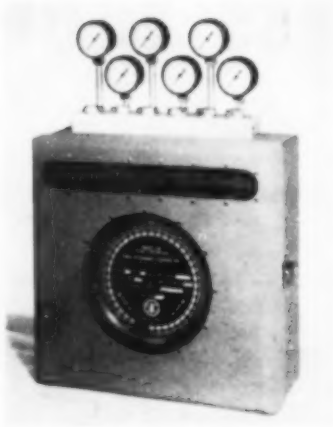
TO ELIMINATE the necessity for the usual bypass around diaphragm valves used for automatic control, the Hammel-Dahl Co., 243 Richmond St., Providence 3, R. I., has developed a continuously connected handwheel valve in which a handwheel built integral with the superstructure of the control valve proper permits the valve



to be operated manually, regardless of the instrument air pressure on the diaphragm or the opposition of the spring. It is stated that in valve sizes 2 in. and larger, elimination of bypasses with their block valves and fittings more than pays for the handwheel, and, in fact, in large jobs, the savings may be sufficient to exceed the total cost of the control valves required. This handwheel can also be used to adjust valve travel stops to prevent overtravel in event of failure ot the instrument air.

5. Cycle Controller

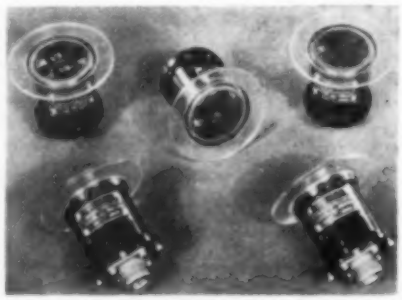
AN ACCOMPANYING illustration shows a multiple-operation controller recently introduced by Seely Instrument Co., 305 Fourth St., Niagara Falls, N. Y. This device can be used to start, time, correlate, and stop multiple operations in any process or machine cycle which can be actuated by air pressure or electricity. Known as



Model PB-2, the controller incorporates a time selector wheel carrying 150 keys which are provided for timing within 0.67 percent of the overall time range for each successive event scheduled in the operation selector. Standard cycles are available to 750 min. An operation selector cam shaft with ten working positions operates pilot valves or precision switches in any desired sequence, according to the pre-setting of the operation selector keys previously mentioned.

6. Indication Transmitter

AUTOMATIC sensing and transmission of the indication of practically any type of industrial instrument employing a pointer can be accomplished by the new No Torque Instrument Pickup developed by Fairchild Camera & Instrument Corp., 88-06 Van Wyck Boulevard, Jamaica 1, N. Y. The pickup is said not to affect the accuracy of the instrument being read, having no torque requirement. It senses the position of the instrument pointer, then converts the position into an electrical phase angle, accurate within a few degrees. It is installed in place of the covering glass window of the instrument, with a small permanent

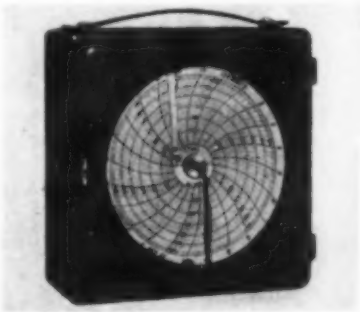


magnet mounted on the indicator shaft whose position is to be read. Indication is obtained by the phase of the magnetic couple between the stationary magnetic field of the instrument pointer and the rotating field of the pickup. A piezo-electric crystal is used to convert this mechanical couple into an electrical voltage, the phase angle of which is a function of the position of the instrument pointer. The indication can thus be transmitted remotely.

This company has also announced a new temperature measuring system for measurement and control of extremely high gas temperatures as high as 5,000 deg. R. The instrument is a form of gas thermometer utilizing the density of the gas being measured as a direct indication of temperature. It is said not to be subject to the usual radiation effects common to present temperature sensing methods. Its accuracy is said to be plus or minus 1 percent to 2,500 deg. R. and plus or minus 2 percent from that temperature to 5,000 deg. F., with response rate of ½ second or less.

7. Miniature Recorder

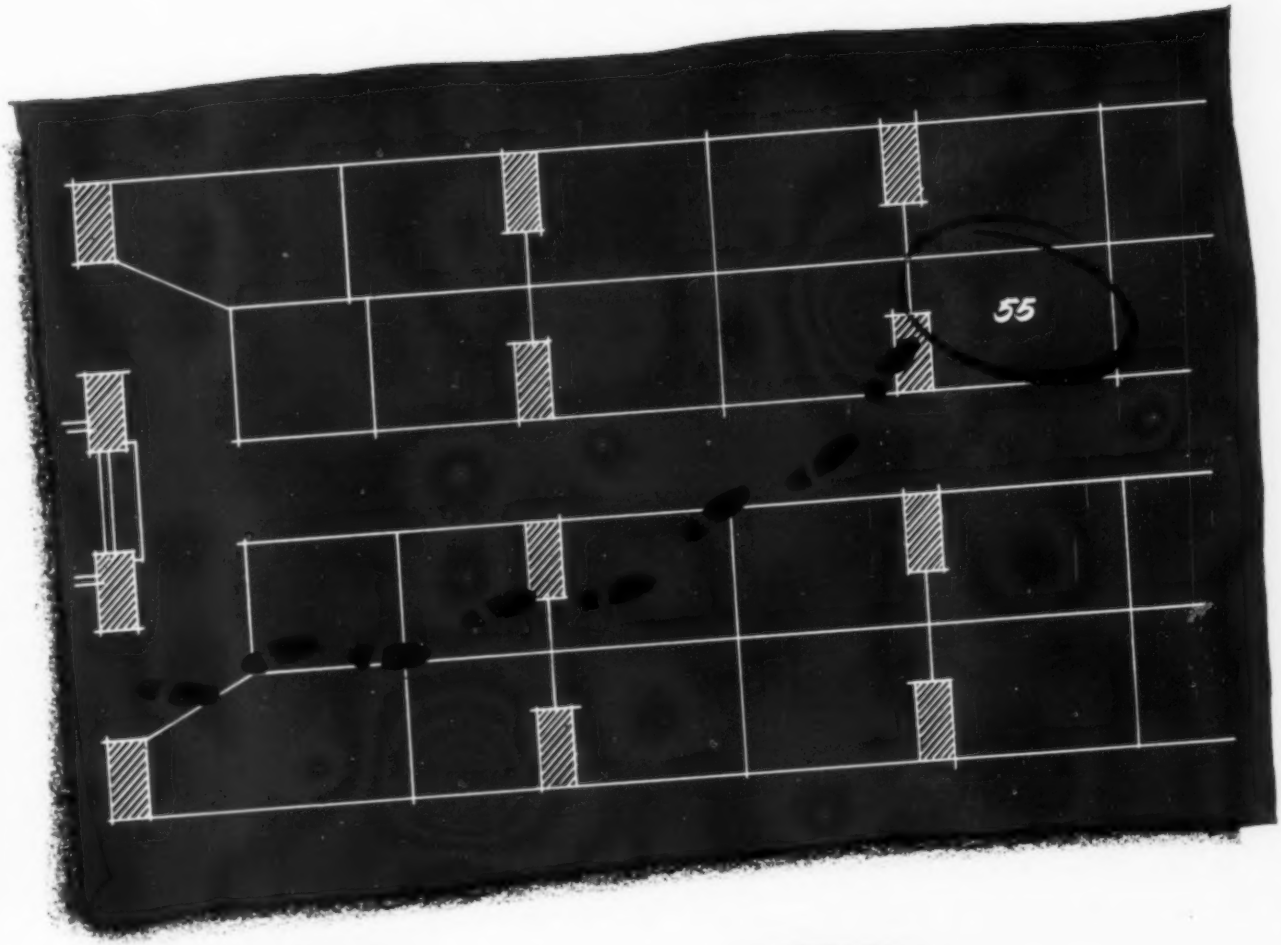
SHOCK RESISTANCE and easy portability are incorporated in a new miniature temperature recorder, weighing less than 3½ lb., which is now available from C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y. The recorder is 5¾ in. square and 4¼ in. deep. It is said to be particularly useful in applications where vibration is encountered. It is available in two



types, a single-pen recording thermometer for temperatures only, and a two-pen recorder for both temperature and time-operating recording.

8. Vacuum Tablet Press

TO TAKE CARE of tablet compressing problems where entrapped air tends to reduce press operating speeds or cause laminations or other defects in the pieces produced, the F. J. Stokes Machine Co., Philadelphia 20, Pa., has developed a new machine in which compressing is done under vacuum at reduced pressures which can be varied to meet the conditions of the particular problem. The press applies a maximum of 20 tons pressure from above



See you at Booth 55

SEE CSC'S EXHIBIT
BOOTH 55
GRAND CENTRAL PALACE
NEW YORK CITY
DECEMBER 1-6, 1947

MAKE TRACKS for Booth 55 at the Grand Central Palace when the 21st Chemical Exposition opens on December 1. You'll see an exhibit of familiar CSC industrial chemicals, plus some notable "firsts" in pharmaceuticals. On display will be samples of more than 200 CSC chemicals for industry, medicine, and agriculture.

CSC

Commercial Solvents Corporation
17 East 42nd Street
New York 17, N. Y.

and below, has a die fill of 2⅜ in. and will produce pieces up to 3 in. in diameter. Pressure from above is exerted by means of an adjustable eccentric crank, and on the lower punch, by cam action. A vacuum chamber surrounds the die table, the punches and the feeding device. The feed hopper, also under vacuum, is attached to the top of the vacuum chamber and a receptacle under vacuum receives the finished parts at the side of the vacuum chamber. The latter receptacle is large enough to hold all pieces produced from one full charge of the hopper.

Although all possibilities for the new process have not yet been explored, the manufacturer believes it should have a wide range of applications. Various advantages are said to include freer feeding, production of thicker pieces with a given depth of fill, higher press speeds, cleaner operation, and reduced wear on machine parts. With a particular ceramic powder, for example, it is claimed that press speeds were increased from 10 tablets per minute at atmospheric pressure to 40 per minute under vacuum. Superior tablets were produced, according to reports.

9. Differential Gage

A 6-IN. DIAL for the accurate measurement of flow, liquid level and pressure differential is featured in the Model 181 differential pressure indi-

cator offered by Barton Instrument Co., 3500 Union Pacific Ave., Los Angeles 23, Calif. The instrument is available for differential pressure ranges from 0.50 in. of water up to 200 psi. It is constructed of drawn bar stock and has a brass rupture-proof bellows rated for static pressures to 3,000 psi.

10. General Utility Pump

DESIGNATED as the Fluidyne, a new single-stage, end-suction centrifugal pump for general utility applications, provided with a vertically split casing, has been introduced by the Peerless Pump Division of Food Machinery Corp., 301 West Ave. 26, Los Angeles 31, Calif. Available with power drive from fractional to 20 hp., the new pump is manufactured in two types, both capable of moving water and other liquids in capacities up to 1,000 gpm. against heads up to 270 ft. Type PE is a close-coupled design with pump and driving motor anchored on the motor footing. Type PB is a belt-driven unit with the iron frame and bearing mounts supporting the various pump sizes integrally cast. The pump is suitable for operating in any position and its design is claimed to stress ease of maintenance and accessibility, coupled with hydraulic characteristics giving high efficiency.

11. High Temperature Insulant

SPECIALLY processed glass filaments, available in lightweight felt and bulk forms for insulating against temperatures up to 1,800 deg. F., are now available from Owens-Corning Fiberglas Corp., Toledo 1, Ohio. In many applications the new insulation is said to provide a removable and replaceable insulation that can take the place of refractories which previously were the only means for insulating such high temperature equipment. In the felt form, in a thickness of ½ in., the new insulation has a weight of 0.047 lb. per sq.ft. The k value at 6 lb. density ranges from 0.57 at 670 deg. F. to 1.65 at 1,700 deg. F., and the k value at 9 lb. density ranges from 0.49 at 670 deg. F. to 1.33 at 1,700 deg. F.

12. Magnetic Separator

A NEW DESIGN of cross-belt magnetic separator, known as the Memco-Wetherill type, has been put out by Magnetic Engineering & Mfg. Co., Clifton, N. J. The machine is used for concentrating feebly magnetic ores, removing contaminating magnetic specks and iron oxide from chemicals, powders, etc., and for segregating magnetic from non-magnetic materials where

extremely clean products are required. Although similar in principle to the old type Wetherill separator, the new design is said to embody many mechanical improvements. The main conveyor belt can readily be changed without disturbing other parts of the separator, while magnetic gap adjustments are more readily made by raising or lowering the lower pole pieces, without disturbing the top magnet. Standard equipment includes multiple magnetic discharge hoppers, a magnetic vibrating feeder, variable speed drive and control panel. Standard sizes range from a main conveyor belt 6 in. wide, to 18 in. wide, with from two to 10 cross belts.

13. Viscometer Extension

As THE accompanying illustration shows, an extension spindle greatly extending the usefulness of the Synchro-Lectric Viscometer has been made available by the Brookfield Engineering Laboratories, Stoughton, Mass. With this spindle, viscosity readings can now be taken where it was formerly impossible to do so owing to boiling, foaming, fumes or other conditions that prevented the operator or instru-

ment from getting close enough to make a reading. The spindle also permits readings to be made where surface turbulence or undulation of the liquid level formerly made accurate readings impossible. Such spindles can be supplied in any length needed and are interchangeable with standard spindles.

14. Explosion-Proof Starter

MANY IMPROVEMENTS are said to be incorporated in the new Class 8508 d.c. explosion-tested line starter offered by Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa. A few of these improvements include a rugged d.c. magnetic contactor with knife edge bearings; packing glands that can be bolted in place to permit assembly of conduit and gland away from the starter, then bolting the assembled unit to the starter; an overload relay

HEYDEN chemicals serve the nation's industries

PLASTICS • RESINS

Performance and appearance, the keynotes of product excellence, are enhanced when you use *dependable chemicals* by HEYDEN.

FORMALDEHYDE — Formaldehyde Solution U. S. P. — High in purity and uniformity — Low acid and metals content.

CONTAINERS: Tank cars, tank trucks (New York metropolitan area only), drums, barrels, kegs, carboys, and bottles.

PARAFORMALDEHYDE — Powder or granular.

CONTAINERS: 25-lb. and 100-lb. fiber drums.

PENTEK® — Pentaerythritol Technical — For mar-resistant coating compositions of alkyd, urea-formaldehyde, and modified phenolic resins. PENTEK finds valuable application in plasticizers and emulsifying agents.

CONTAINERS: 75-lb. multi-wall paper bags.

HEXAMETHYLENETETRAMINE — Acts as a flux in the molding powder; valuable as a methylenating agent to effect the final hardening; liberates ammonia, an active catalyst, and shortens the curing time.

CONTAINERS: U.S.P. and Technical Grades, 100-lb. fiber drums.

LIGNOCOL® — A standardized antioxidant and anti-skinning agent for paints, varnishes, lacquers, printing inks, and putties . . . prevents skinning without increasing the drying time.

CONTAINERS: 450-lb. stainless steel drums; 50-lb. boxed tin cans.

FINE HEYDEN CHEMICALS

HEYDEN CHEMICAL CORPORATION

393 SEVENTH AVENUE, NEW YORK 1, N. Y.

CHICAGO OFFICE, 20 North Wacker Drive

PHILADELPHIA OFFICE, 1700 Walnut Street

Benzaldehyde • Benzoates • Benzoic Acid • Benzyl Chloride
Bromides • Chlorinated Aromatics • Medicinal Creosotes
Formates • Formaldehyde • Formic Acid • Glycerophosphates • Medicinal Guaiacols • Hexamethylenetetramine
M.D.A. • Paraformaldehyde • Parahydroxybenzoates
Penicillin • Pentaerythritols • Salicylates

VINYON*

. . . EXCELLENT FILTER MEDIUM FOR MINERAL ACIDS AND MINERAL ALKALIES

Tests show "excellent resistance—no attack" with all concentrations of hydrochloric, hydrofluoric, sulphuric and nitric acids; also aqua regia. The same is true of sodium and potassium hydroxides; chlorine and bromine waters; potassium permanganate and dichromate; silver nitrate and tannic acid. VINYON* can handle many oils, fats and waxes. It will not support bacteria and fungi.

The temperature limit for VINYON* is a little lower than that of its companion plastic fiber medium, SARAN†, being about 150° F. Above this temperature shrinkage occurs.

Why not order a test sample of VINYON* and see if it is better chemically than the filter medium you are now using. Mechanically it is strong and the weaves are such as to give excellent filtering results. In writing for your sample, tell us about the products to be filtered.

† TM Dow Chemco

The FM Line of Filter Media Includes:
Cotton Filter Cloths • Glass Filter Cloths
Rubber Filter Media • Plastic Fiber Cloths
Rubber Covered Screens
The Correct Medium for any Problem

Filter Media Corporation

SPECIALISTS IN FILTER CLOTH FOR INDUSTRIAL FILTRATION

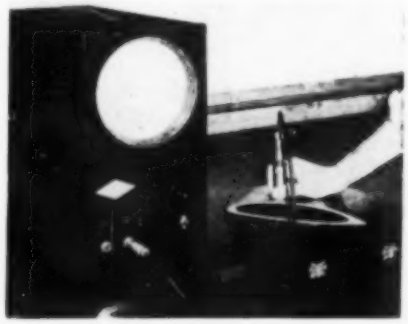
HAMDEN 14, CONNECTICUT

CHICAGO SALT LAKE CITY

arranged for either manual or automatic resetting; and a smaller inclosure. The starter is built for d.c. motors up to 5 hp. on circuits from 80 to 550 volts. All tests of the Bureau of Mines for "explosion-tested" equipment have been passed. The push button and reset button are mounted in the cover, but the former may be located remotely if desired.

15. Thickness Gage

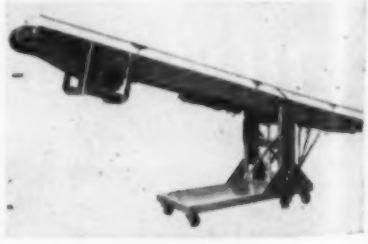
THICKNESS of metals and other materials can be measured where access from only one side is available with the new Reflectogage developed by Sperry Products, Inc., 15th St. and Willow Ave., Hoboken, N. J. This instrument, utilizing supersonics, supplements the supersonic Reflectoscope



and the Thruray already manufactured by this concern. It is claimed to give measurements with a maximum error of less than 2 percent of the thickness of the material. Thickness of tubing and flat parts, between 0.005 and 0.3 in., can be read directly from the face of the oscilloscope screen, while indirect readings of the thickness of parts up to 4 in. can be accomplished with slight calculation. The instrument employs a quartz crystal searching unit which is applied to the oiled surface of the material to give a thickness indication on the oscilloscope.

16. Portable Belt Elevators

TWO NEW belt elevators, the Streamliner, and the Streamliner, Jr., have been announced by the Harry J. Ferguson Co., 151 West Ave., Jenkinton, Pa. The first of these has a 15 ft. long bed, and the second a 10 ft. long bed. Both types may be raised and lowered by means of a hydraulic jack. Both



...all are Success Stories for INTERLAKE *Resineering*

Here are three typical examples of resin-treated products that have benefited by Interlake ***Resineering***—the functional engineering of a resin for the specific job requirements. In every case, Interlake ***Resineering*** helps insure a product of top quality, made without production problems and using a resin that costs no more.

Basically Interlake Resineering consists of:

1. **ANALYSIS** of your resin problem followed by our recommendation.
2. **DEVELOPMENT** of a resin suited to your particular application.
3. **JOB TESTING** this resin, in *your* plant, working with *your* men.
4. **STABILIZED PRODUCTION** of the resin for uniformity in performance.

Avail yourself of this complete service by writing The Interlake Chemical Corporation, Union Commerce Bldg., Cleveland 14, Ohio.

Basic Applications of Interlake Resins Include . . .

BONDING—wood, veneer, corestock, cellulose waste and fibrous materials.
SURFACING—wood, paper and fabric.
LAMINATING—fabric, paper and wood.
IMPREGNATING—wood, plaster and other cellular materials.

INTERLAKE CHEMICAL Corporation

• PRODUCTS FROM COAL •

Atlas Dual Construction; Carbo-KOREZ and Tegul-VITROBOND; lined with Atlastiseal. Exteriors protected with Atlastic No. 31. Tank tops of reinforced concrete faced on inside with liner plates joined with Carbo-KOREZ. Small top openings fitted with Saran piping. These materials are described in our Bulletin.

ARE PART OF THE MODERN EQUIPMENT OF ONE OF THE MOST MODERN EASTERN CHEMICAL PLANTS

The stored hydrochloric acid is contaminated with organic acids and solvents . . . and these Atlas tanks are completely proof against this punishing combination. Please note that we said *"proof* against" . . . not just "resistant to".

The design is Atlas DUAL CONSTRUCTION (Patented), a better way of building tanks to handle fighting corrosives . . . and one which offers advantages and economies unavailable in any other type of construction.

Name your corrosives and Atlas will provide construction best suited to withstand their attacks.

Atlas Materials include cements, plastic linings, jointing materials and protective coatings . . . used in tanks, floors, fume ducts, drains, neutralizers, etc. These Atlas materials are immune to acids, alkalis, solvents, water, steam and elevated temperatures.

Atlas Service includes specification writing, analysis of design, supervision and installation. Our engineers will gladly work with you, submitting plans and estimates without obligation. Get in touch with the Atlas representative at our nearest office. Meantime, write our head office here at Mertztown for Bulletin TB-11.

THE Atlas Mineral

PRODUCTS COMPANY OF PENNA.

MERTZTOWN, PENNSYLVANIA

*ATLANTA 3, Ga., 452 Spring St., N. W.
*CHICAGO 1, Ill., 333 No. Michigan Ave.
*DETROIT 2, Mich., 2970 W. Grand Blvd.
NEW YORK 16, N. Y., 280 Madison Ave.
PITTSBURGH 27, Pa., 4921 Plymouth Rd.
PHILADELPHIA, Pa., 355 Fairview Rd. Springfield, Pa.
ST. LOUIS 8, Mo., 4485 Olive St.

THE ATLAS MINERAL PRODUCTS CO. OF TEXAS, INC. Box 252, Houston 1, Texas

DALLAS 5, Tex., 3921 Purdue St.
*DENVER 2, Colo., 1921 Blake St.
*HONOLULU 2, Hawaii, U.S.A., P.O. Box 2930
OMAHA, Neb., 423 South 28th
*KANSAS CITY 2, Kan., 1913 Tauromee Ave.
*LOS ANGELES 12, Cal., 172 S. Central Ave.
NEW ORLEANS 12, La., 209 Vincent Bldg.
*SAN FRANCISCO 3, Calif., 244 Ninth St.
*SEATTLE 4, Wash., 1252 First Avenue, S.
*Stock carried at these points

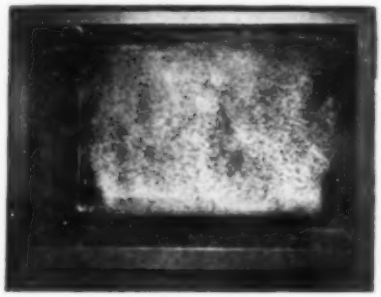
IN CANADA: Atlas Products are manufactured by H. L. BLACHFORD, Limited, 977 Aqueduct Street, Montreal, P. Q., 86 Bloor St. W., Toronto, Ont.

FOR MORE INFORMATION
See Reader Service Coupon on pages 171–172

types are mounted on carriages for ready portability. Each is equipped with a motor of the proper size, together with the necessary starter and electric cable. Both incorporate arrangements for preventing creeping while in operation.

17. Air Diffuser

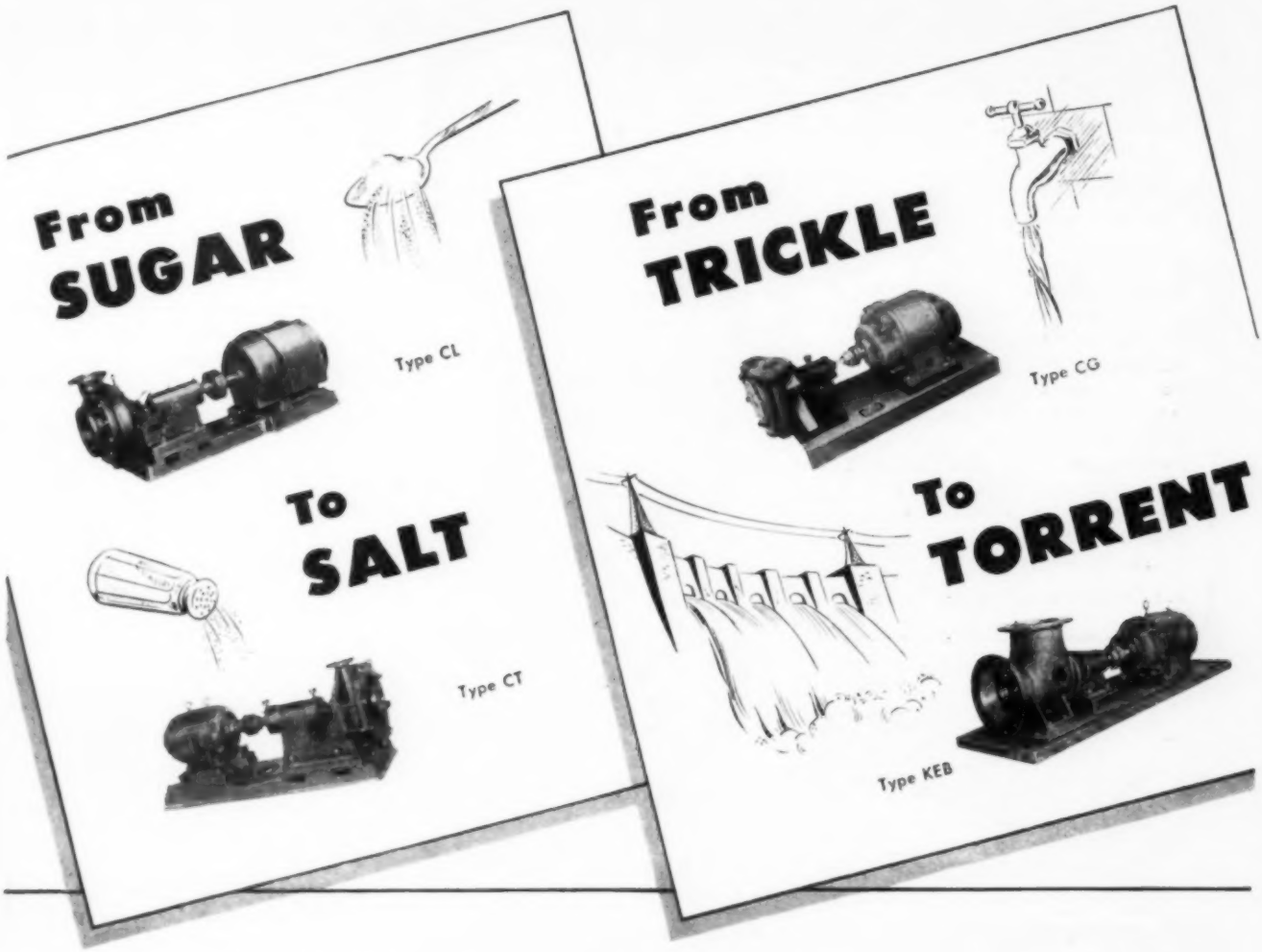
DEVELOPED both for the activated-sludge process of sewage treatment, and for air diffusion and gas mixing in the process field, a new type of diffuser tube has been developed by



the Chicago Pump Co., 2315 Wolfram St., Chicago 18, Ill. The new Chicago precision tube is made of corrugated stainless steel, mechanically wound with Saran plastic cord. This construction is said to be 60 percent lighter than previous diffusion media but to be exceptionally strong. The tube is claimed to provide for quicker and more effective cleaning and to yield fine-bubbled diffusion from its entire active surface at all air rates. Lower head loss is claimed at all air rates. There is said to be no progressive clogging with cleaned tubes, which are restored to their original performance.

18. Safety Tile

FOLLOWING extensive field and U. S. Navy tests as a safety trend, the American Abrasive Metals Co., Irvington, N. J., has introduced Amcolun safety tile which is a homogeneous, compact structure composed of abrasive material and other inert fillers, bonded together with a heat-resisting thermosetting phenolic resin to form a tile which is said to be slip-proof and extremely durable. The abrasive used is aluminum oxide. The new tile is said to be much more resistant to



Worthington Standard Centrifugal Pumps serve all processing industries

Whether your pumping problems involve corrosion, abrasion or contamination, or are strictly hydraulic, you'll find efficient, economical, *ready-made* answers in Worthington Centrifugal Pumps.

"Across the Board" in Chemicals

Worthington Worthite Pumps, for example, are something extra-special in stainless steel alloys. Developed to handle the widest range of pump-punishing liquids, they are equally resistant to corrosive, low pH sugar syrups and corrosive-abrasive brine slurries at the boiling point.

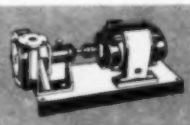
As for Capacities . . .

Worthington Centrifugal Pumps deliver from 5 to 18,000 gpm, smoothly and steadily at all usual heads and speeds. In short, to all industrial processing—from paper to plastics, from rayon to rubber—Worthington offers more pumps for more jobs, plus the longest experience in the field. For details proving *there's more worth in Worthington*, contact our nearest District Office or *Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*

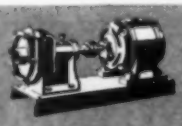
WORTHINGTON

C7-7

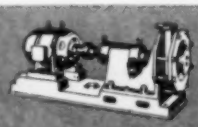
THE WORLD'S LARGEST MANUFACTURER OF PUMPS



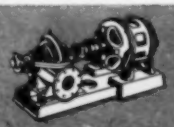
Types CB and CGL. Sizes ½" to 10". Capacities to 5000 GPM; heads to 200 ft. Liquid ends of WORTHITE alloy.



Type CF. Sizes 1" to 4". Capacities to 1000 GPM; heads to 130 ft. Standard, all iron and all bronze.



Type CQ. Sizes 1½" to 3". Capacities to 600 GPM; heads to 130 ft. at 1750 RPM. Closed impeller. WORTHITE shaft and fittings.

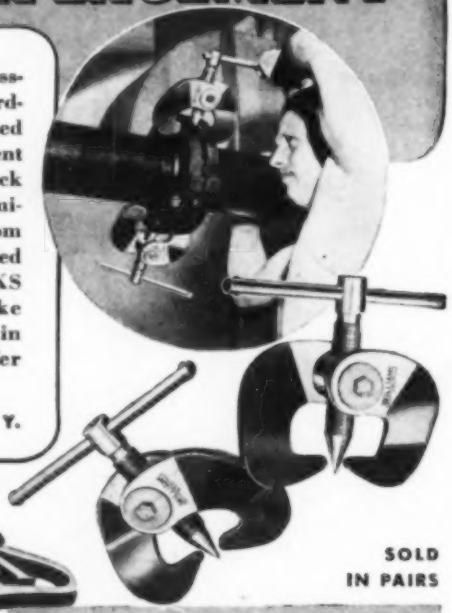


Type L. Sizes 3" to 8". Capacities to 1250 GPM; heads to 300 ft. Single stage volute. For general service.

FOR
FAST • SAFE • EASY
GASKET REPLACEMENT

● The only tool that takes the guesswork out of replacing gaskets, regardless of location. Flanges are parted quickly and held in perfect alignment without damage to faces . . . shock and jarring of pipe lines are eliminated . . . there is no danger from flying wedges . . . no sparks caused by hammer blows. FLANGE-JACKS eliminate costly shutdowns, make possible fast, economical repairs in hard-to-get-at locations . . . offer maximum safety.

J. H. WILLIAMS & CO., Buffalo 7, N. Y.



Standard No. 20 $24.00 a pair
Giant No. 30 $48.00 a pair
See your distributor for trade discounts

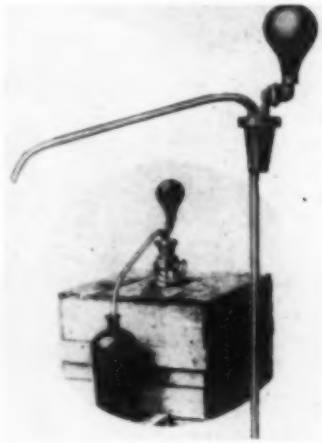
SOLD IN PAIRS

WILLIAMS Flange-Jacks

breakage from shock impact than either asphalt or ceramic tile. It is also light in weight, averaging, installed, only 3½ lb. per sq.ft., including the special adhesive used. The tile is said to be unaffected by most alkalis and acids and to have practically zero water absorption.

19. Carboy Pump

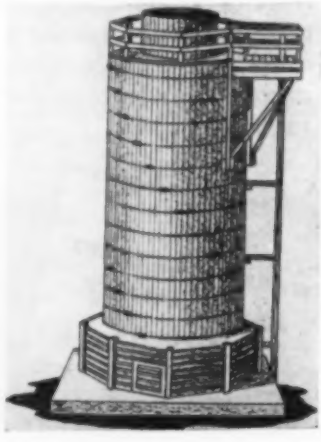
FOR ADDED safety in removing acids and other corrosive liquids from carboys, drums or barrels, the General Scientific Equipment Co., 27th and



Huntington Sts., Philadelphia 32, Pa., has announced an acid-proof manually-operated pump supplied in both hand- and foot-operated models. Either can be provided with a lead tube for such acids as sulphuric, or with a Saran tube for such acids as nitric. Special tube lengths can be supplied at slight additional cost.

20. Cylindrical Cooling Tower

SAID TO BE the first of its kind, a new design of cylindrical cooling tower has been put on the market by Santa Fe Tank & Tower Co., 5401 South Boyle Ave., Los Angeles 11, Calif. The cylindrical tower is said to eliminate dead air spaces and to allow air to



For Reliable Performance...
FILTER UNITS by MULTI-METAL

Advanced design, in combination with improved materials and craftsmanship of the highest order, insures the superior performance of Multi-Metal Filter Units. Whether you require specially-fabricated or stock units, you will find that Multi-Metal is better equipped to serve you.

Multi-Metal's complete reconditioning service makes old filter units perform like new. Filter Leaves for standard equipment are stocked for immediate shipment. Special units can be made promptly to your exact specifications.

Always in stock — wire and filter cloth of all meshes, weaves, and metals. Order by the yard, piece, or roll.

Write for catalog and free wire cloth samples.

More than 35 years of service to process industries

Multi-Metal
WIRE CLOTH COMPANY, INC.
1350 Garrison Ave., New York 59, N. Y.

COST CUTTERS

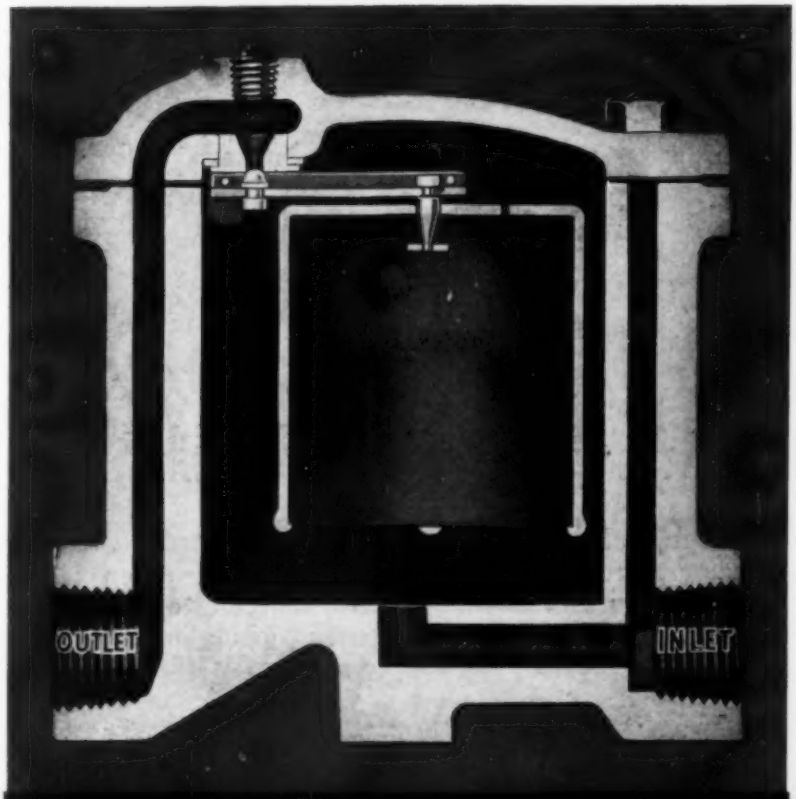
CHEMICAL PLANTS.. cut costs with CLARK STEAM TRAPS. Large volume air removal gives quicker heating up action—saves fuel. Elimination of condensate permits rapid, full flow of new dry, live steam—extends life of equipment.

For 38 YEARS...

fluid controls made by Clark have been saving fuel and increasing equipment efficiency wherever steam, air or gas are used.

Cost Cutters in...

- **Laundry and Dry Cleaning Establishments**
- **Petroleum Refineries**
- **Food Processing and Canning Plants**
- **Meat Packing Plants**
- **Steel Plants**
- **Breweries**
- **Chemical Plants**
- **General Industry**



The popular **CLARK SERIES 70** Inverted Bucket Type Steam Trap with Clark patented Bucket Venting Device and other exclusive Clark features. For general drainage service. Available in 3 sizes: ½", ¾" and 1". For pressures up to 200 P. S. I. and temperatures up to 400° F. Write for free catalog for complete specifications and applications of the wide line of Clark Fluid Controls.

Clark
FLUID CONTROLS

THE CLARK MANUFACTURING COMPANY · DEPT.D · CLEVELAND 14, OHIO

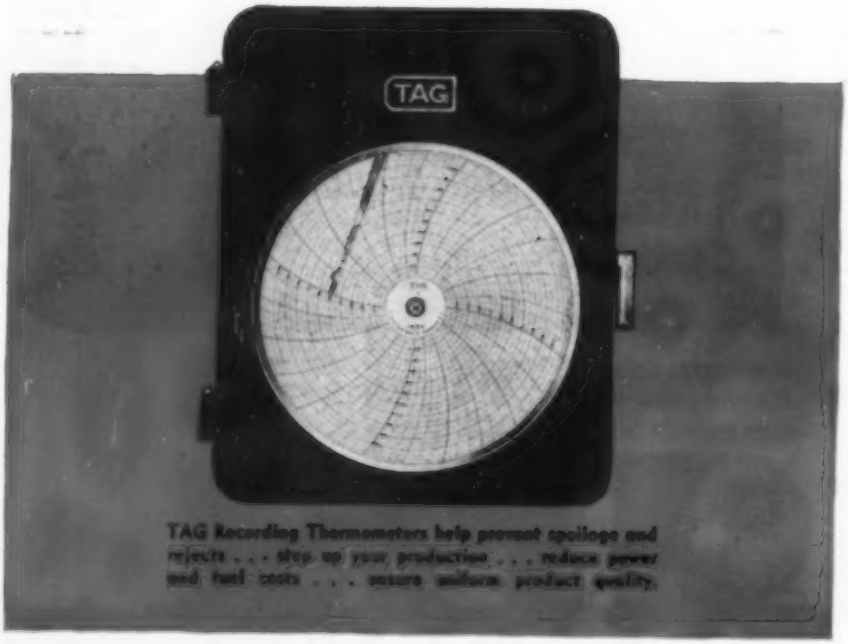
Makers of a wide line of fluid controls including

STEAM AND FLUID TRAPS	STRAINERS	PRESSURE REGULATORS
VACUUM AND LIFTING TRAPS	VALVES	REDUCING VALVES

Locksley, famed archer of fiction, had to split his opponent's arrow in order to win the tournament. He did it, too! That was one time ACCURACY PAID OFF.

TAG Accuracy arms you with facts . . .

and pays off when you refer to TAG Recorder charts for temperature and pressure data. These written records provide you with an authoritative source of answers to the temperature and pressure questions arising in your process. Write for your copy of the complete TAG Recorder catalog 1210A.



TAG Recording Thermometers help prevent spoilage and rejects . . . step up your production . . . reduce power and fuel costs . . . assure uniform product quality.

C. J. TAGliabue Mfg. Co.
542 Park Avenue Brooklyn 5, N. Y.
Representatives in Principal Cities

Always Specify TAG

SUBSIDIARY OF PORTABLE PRODUCTS CORP.

FOR MORE INFORMATION
See Reader Service Coupon on pages 171–172

enter the tower from any point of the entire 360 deg. circumference, thus achieving more even distribution of air as compared with designs having the air inlet only on two sides, or two sides and four corners. The design is also said to lessen the wind load, thus reducing the load transmitted to the supporting structure. The tower is available in either individual or multiple-cell units, either of wood or of steel construction.

21. Fork Side Shifter

LATERAL movement of loads on fork trucks is accomplished by a new fork lift truck accessory, the Side Shifter, which is being offered by Towmotor Corp., Cleveland 10, Ohio. The

device eliminates the truck maneuvering that is often required where loads must be positioned exactly, especially in stacking. The carriage support can be moved a distance of 3½ in. in either direction. The accessory is applicable to standard Towmotor forks, as well as Priester and Schmidgall forks.

22. Flammable Vapor Detector

NEW INSTRUMENTS for the detection of combustible mixtures have been introduced by Jabez Burns & Sons, Inc., 11th Ave. and 43rd St., New York 18, N. Y. One instrument,

ILLUSTRATES and DESCRIBES EQUIPMENT for:

(1) Size Reduction
(2) Materials Handling
(3) Mixing and Blending
(4) Size Classification

TELLS how you can profit from the extensive processing data file and wealth of practical experience available through the Sprout-Waldron organization. A convenient reference bulletin for your assistance in selecting the type of equipment best suited to the job.

Eight pages jam-packed with concrete application references

Visit Us at Chem Show Booths 550-553

SEND FOR YOUR COPY TODAY ➡

Sprout-Waldron & Co., Muncy, Pennsylvania

Gentlemen: Please send me a free copy of your bulletin SCEC-4748-4.

Name _____

Title _____

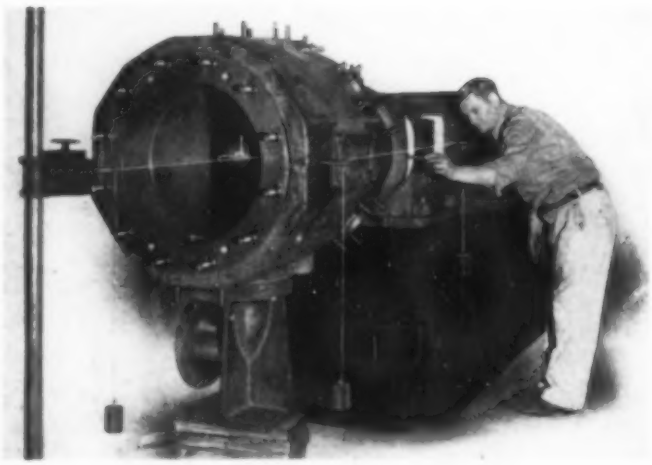
Company _____

Address _____

SPROUT WALDRON
Manufacturing Engineers

S 1167

IT'S A NORWALK



HIGH PRESSURE COMPRESSOR

Built by the Pioneers of the Industry

This four-stage compressor is ready for final assembly at the Norwalk plant, where it will be test-run for eight hours. Cylinders are perfectly aligned by the piano wire method, and three pins located outside the cylinders so that the alignment can be accurately checked at the time of installation. Line-up pins are provided with each compressor, together with complete instructions for their use.

NORWALK COMPANY, INC.

10 NORTH WATER STREET, SOUTH NORWALK, CONN.

Manufacturers of High Pressure Compressors for Air and Gases for more than 80 Years

known as the Thermalo flammable vapor detector, may be used to detect the presence of flammable vapors of any kind before the lower explosive limit of concentration is reached. The unit consists of one or more detector cells located in the area where vapor-air mixtures are normally present or may occur, and an instrument control case which may be situated at any desired distance from the cells. It is equipped with red and green signal lights to inform the operator, as well as a contact relay which is automatically activated by unsafe conditions to operate the signal light and controls. Once the instrument operates, the circuit through the detector cell is disconnected and cannot be reconnected until the atmosphere again reaches a safe condition. The same cell may be used for any one of many different vapors by appropriate calibration.

This company has also introduced a new gas detector for protecting gas-fired processing equipment. This instrument detects unburned gases from leaky or carelessly closed valves, or incomplete combustion, indicating the degree of concentration on a dial and automatically operating an alarm or control to shut off a gas valve in the supply line should the concentration reach the danger point. The instrument is a special adaptation of the flammable vapor detector.

23. Adjustable-Speed Motor

Its Tri-Clad type of construction has now been applied by the Motor Division of General Electric Co., Schenectady, N. Y., to a brush-shifting, adjustable-speed induction motor, Type ACA, which is available in ratings from 3 to 50 hp., for voltages from 220 to 550. The new motor features step-

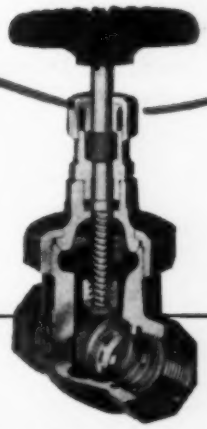
less speed adjustment over a 3-to-1 ratio by simply turning a dial. The entire unit, except for the starter control, is self-contained in a housing only a little larger than that of a constant-speed motor of comparable rating. If desired, remote control can be applied mechanically up to 10 ft., or electrically over longer distances. The motor is cooled by double-end ventila-

SET for the life of the line

0236—200 lbs. S. W. P.

UNION BONNET BRONZE GATE VALVE

Engineered in every detail to provide maximum service under the toughest operating conditions. Hard nickel alloy seats and wedges resist corrosion. Union Bonnet (with heavy octagonal nut) assures great strength, 100% tightness under pressure, yet permits quick, easy dismantling for cleaning and inspection. To eliminate high maintenance costs, shutdowns or other operating problems, install Fairbanks Union Bonnet Bronze Gate Valves. Recommended for steam (200 lbs.), water, oil or gas. Sizes ½" through 2". The Fairbanks Company, 393 Lafayette St., New York 3, N. Y.; 520 Atlantic Ave., Boston 10, Mass.; 15 Ferry St., Pittsburgh 22, Pa.; 748 M & M Bldg., Houston 2, Texas.



0232

UNION BONNET BRONZE GATE VALVE

Non-Rising Stem.

All parts interchangeable with Rising Stem Type. Sizes ½" through 2".

American industry flows through fairbanks valves

THIS HISTORY-MAKING HANDFUL

IS WORTH LOOKING INTO...

LOW-COST PRODUCT-IMPROVING

Extender for Shellac

and other imported resins

Valite 7796-D

NEW THERMOPLASTIC RESIN

Discovered in the VALITE laboratories — now in full production — this new synthetic resin opens tremendous industrial possibilities as a low-cost extender and plasticizer for shellac and other imported resins...

- **FULLY THERMOPLASTIC — completely recoverable**
- **UNIFORM QUALITY — scientifically controlled**
- **UNLIMITED QUANTITIES — for immediate delivery**
- **ATTRACTIVE LOW PRICE — less than half the current market price of shellac**
- **DESIRABLE SOFTENING POINT — 195° F. to 205° F.**
- **SOLUBLE — in mixed organic solvents. Tests indicate workability into oil soluble form**

If your company uses shellac, VALITE 7796-D may provide the very answer you are seeking — a BETTER PRODUCT at LESS COST.

Highly successful application by major manufacturers of phonograph records has opened the way to a multitude of other industrial adaptations, many of which are still undeveloped.

WRITE US for more information, stating your particular requirements. WE WILL GLADLY SEND sufficient quantities of VALITE 7796-D for your own laboratory investigation.

Valite
EXCLUSIVE TRADE MARK

VALITE CORPORATION

DEPT. 55 400 W. MADISON ST. • CHICAGO 6, ILL.

SALES AGENTS:

WM. E. MUNN
96 Liberty St.
New York City 6, N. Y.

BARADA & PAGE, INC.
Kansas City—St. Louis—Okla. City—Tulsa
New Orleans—Dallas—Houston—Wichita

FOR MORE INFORMATION
See Reader Service Coupon on pages 171–172

tion and is provided with necessary overload protection and limit switches. It is said to have a high power factor at high speed and a power factor about the same as a squirrel cage induction motor of similar rating at synchronous speed. The motor is reversible for short periods of time by reversing two power leads.

Equipment Briefs

24. A LABORATORY evaporator to bridge the gap between small laboratory apparatus and the pilot plant has been announced by Precision Scientific Co., 3737 West Cortland St., Chicago 47, Ill. Constructed on the same general principles as large industrial units, the evaporator can operate under vacuum, can use steam pressures as high as 150 psi, and is constructed of stainless steel and Pyrex glass.

25. A SPECIAL alloy seamless bronze tube, formed into a uniform helically corrugated flexible hose, is employed in the new seamless flexible metal hose made by Brockway Co., Naugatuck, Conn. The corrugated element of the new Uniflex hose is encased in a high-tensile bronze wire braid permanently attached at the ends to carefully designed couplings which provide a metal-to-metal seal with the hose itself.

26. UNDER the name of Chemiseal, the United States Gasket Co., 525 North St., Camden, N. J., has introduced a chemically inert gasket fabricated from Teflon. No known material except melted sodium and fluorine under pressure reacts with this material or causes any physical change. Temperatures ranging from minus 200 to plus 500 deg. F. can be accommodated without brittleness or decomposition.

27. A NEW IDEA in roller supports for pipe is being offered by Unistrut Products Co., 1013 Washington Blvd., Chicago 7, Ill. A single size of roller assembly can be provided with axles of varying lengths to support pipes ranging all the way from 1 to 12 in. This is said to greatly simplify the problem of stocking and supplying parts for roller pipe supports to accommodate numerous different pipe sizes. The roller supports are mounted on an adjustable Unistrut frame member to permit simple pipe installation.

NEW PRODUCTS AND MATERIALS

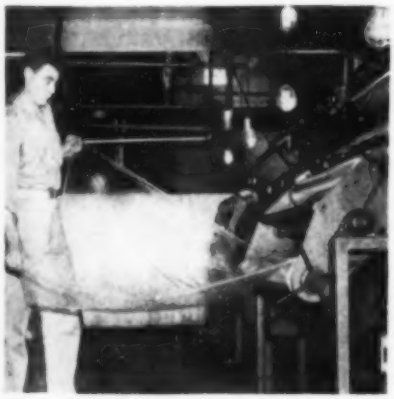
Richard W. Porter, ASSISTANT EDITOR

CONTENTS

Packaging Film	175
Basic Organic Chemical	175
Surface Coating	175
Acid-Resisting Glass	176
Anti-Acid Lubricant	176
Aluminum Paint	176
DDT Insecticides	178
Polyethylene Tubing	178
Adhesive	178
Moisture Resistant Resin	180
Paint Ingredient	180
Plasticizers	180
Stiffening Agent	182
Coating for Aluminum	182
Cellulose Ester Plastic	184
Plasticizing Resin	184
Water-Shedding Film	184

51. Packaging Film

A CLEAR, tough, flexible packaging film cast from a colloidal dispersion of polyvinyl chloride plastic in water has been announced by the Reynolds Research Corp., Gary, Ind. Called Reynolon, the new film is made from Geon latex, a product of B. F. Goodrich Chemical Co. The casting of the latex is done on a continuous stainless steel belt over 300 ft. long. The belt passes through a specially designed oven where temperatures are automatically controlled to plus or minus 2 deg. F. After passing through the temperature zones the belt continues back through an area where the film is cooled, stripped and wound on a roll by automatic tension control equipment. Processing films from latex is said to eliminate flammable solvents and also the retention of solvents which are objectionable in food wrapping. Solids content may run as high as 60 percent. Well adapted for use on most automatic packaging equipment, Reynolon is suited for food packaging and protective coverings of many types, according to the makers. Available in gages ranging from 1 to 3 mils in widths of 36 to 46 in., it can be sewed or electronically heat sealed. The material resists moisture-vapor transmission. It has good light and heat stability with film thicknesses controlled to plus or minus 0.0001 in. The manufacturers claim that the new film can be modified to any degree of stiffness or softness. Colors and pigmented films can be supplied for special cases.



52. Basic Organic Chemical

EXPERIMENTAL production of beta-propiolactone has begun in the B. F. Goodrich Chemical Co., Cleveland, Ohio. Wide use as a basic chemical is expected for it by the manufacturers. As well as making possible the production of a number of new chemicals, beta-propiolactone is expected to open up new and cheaper methods of making many basic materials already used, according to the B. F. Goodrich Co. Substances which may be made from the new material are said to include leather processing materials, fats and oils, preservatives, thermosetting resin products, plant-growth initiators and mold-growth inhibitors. The list includes also synthetic rubbers, fungicides, selective weed killers, polymerizable esters for plastic products, intermediates for the paint industry, rubber compounding chemicals and solvents. Coal, water and ethyl alcohol are the raw materials from which beta-propiolactone comes. Fundamentally the substance is the combination of ketene and formaldehyde.

FOR MORE INFORMATION
See Reader Service
Coupon on pages 171–172

53. Surface Coating

RESISTANT to solvents and to abrasion is a film that remains after allyl starch has dried. As a surface coating this product is expected by the manufacturers to prove useful to the printing ink and protective coating trades. Originally developed at the Eastern Regional Research Laboratory, allyl starch is now being made on a pilot plant scale by the General Mills Research Laboratories, Minneapolis, Minn. The company's laboratory tests indicate that it may be used as a synthetic coating, shellac substitute, protective and decorative coating on wood, glass and metal, as a furniture varnish, thermosetting adhesive, printing ink base, textile finish, leather dressing, and for use in paper impregnation, the grease proofing of paper, and in nail polishes. When vulcanized it forms a rigid plastic and therefore is of interest as a laminating agent. The new coating material is a slightly yellow-colored solid which polymerizes in contact with air to give a hard, brittle film. To prevent brittleness and produce a smooth lacquer-type finish, it has been found that plasticizers may be added in the amount of 10-20 percent. Allyl starch is compatible with such materials as phthalate and sebacate esters, phosphate esters, the numerous abietic acid derivatives, some alkyd resins, chlorinated hydrocarbons, rosin and silica derivatives. It is incompatible with drying oils and most cellulose derivatives. In general, allyl starch is soluble in alcohols, ketones, esters, halogenated hydrocarbons, nitroparaffins, ethers and in some aromatic hydrocarbons. It is insoluble in aliphatic hydrocarbons. The curing of an allyl starch film at room temperature ordinarily takes several weeks. It will cure, however, in two hours at 95 deg. C. and one hour or less at 130-150 deg. C. No polymerization catalysts are needed when applying this rapid

PROTECT YOUR PROCESS *in*

PULVERIZING
GRINDING
GRANULATING
MIXING
DISPERSING
COMPOUNDING
SIFTING

with **ABBÉ** *Equipment*

These catalogs give complete escriptions, operating data and instructions for proper selection of the equipment you need.

Write for these Catalogs

ABBÉ ENGINEERING CO.—42 CHURCH ST., NEW YORK 7, N. Y.

New L-578 SERIES IMMERSION THERMOSTATS

8 FEATURES

1. **ACCURATE AND POSITIVE IN ACTION.** The result of design-simplicity.
2. **VISUAL LEVELING INDICATOR.**
3. **COMPLETE SELECTION OF TEMPERATURE RANGES AND SWITCH COMBINATIONS.** Models to meet every requirement.
4. **FAST REACTION TO LIQUID TEMPERATURE CHANGE.** Two-inch well provides large heat-exchange area for direct and proximity contact with temperature-sensitive element.
5. **CLOSE TEMPERATURE DIFFERENTIAL.** Approximately 10° F. in most installation conditions.
6. **TEMPERATURE SETTING EASILY CHANGED.** Just one external adjustment screw to turn.
7. **AMPLE CURRENT CAPACITY FOR USE IN ALL STANDING CONTROL SYSTEMS.** Up to 15 Amp. switch rating.
8. **MERCURY TYPE SWITCH.** Dust-proof, tamper-proof, impervious to corrosive atmospheric conditions and "pitting" characteristics.

GENERAL CONTROLS
801 ALLEN AVENUE GLENDALE 1, CALIF.
Manufacturers of Automatic Pressure, Temperature & Flow Controls
FACTORY BRANCHES PHILADELPHIA • ATLANTA • BOSTON • CHICAGO • DALLAS
KANSAS CITY • NEW YORK • DENVER • DETROIT • CLEVELAND • PITTSBURGH
HOUSTON • SEATTLE • SAN FRANCISCO • DISTRIBUTORS IN PRINCIPAL CITIES

FOR COMPLETE SPECIFICATIONS REQUEST BULLETIN SOL-320.1

251

curing process. At room temperature curing time can be reduced to two days by the use of metallic dryers. Allyl starch is available in pint, quart and gallon quantities. Because it polymerizes when in contact with air, allyl starch is shipped and stored in solution.

54. Acid-Resisting Glass

PLANS for the manufacture of a new glass are now being made by the Houdry Process Corp., Marcus Hook, Pa. Developed for use with uranium hexafluoride in the atomic bomb project, it is the first glass ever known to resist the attack of hydrofluoric acid. Tested for its acid resisting property, the new glass was immersed in a bath of hydrofluoric acid for 50 hr. At the end of that time, it is said that the glass was substantially transparent and to the naked eye showed no obvious attack. Containing no sand, the glass is composed to a large extent of phosphorus pentoxide. It should simplify the handling and transporting of hydrofluoric acid test tubes, beakers, bottles, evaporating dishes, laboratory and factory window panes and safety goggles and helmets will all be fabricated from the new material.

55. Anti-Acid Lubricant

FOR THE PROTECTION of metal surfaces against direct acidic attack or the corrosive action of vapors, Masters Anti-Acid Lubricant is made by James K. Harbinson & Co., Inc., Buffalo 2, N. Y. Compounded for severe chemical service, it is claimed that this lubricant is unaffected by mineral acids and mild caustics. When it is thoroughly worked into the packing fibers, it is reported that the useful life of the packing is prolonged. Best results are obtained in lubricating pump packing when the compound, having been heated beforehand, is applied in liquid form. It can be injected into a grease cup in the usual way. Lubrication while the pump is in service is thus facilitated. As a reinforcing agent, it is said to increase the efficiency of any packing.

56. Aluminum Paint

NOW AVAILABLE from the Prufcoat Laboratories, Inc., 63 Main St., Cambridge 42, Mass., is a new coating material for general maintenance painting, indoors and out. Called Prufcoat Aluminum, it is made with particles of aluminum powder and a synthetic resin vehicle said to be acid, alkali and water-proof. It can be applied on a reasonably dry, clean surface and seals in all average surface

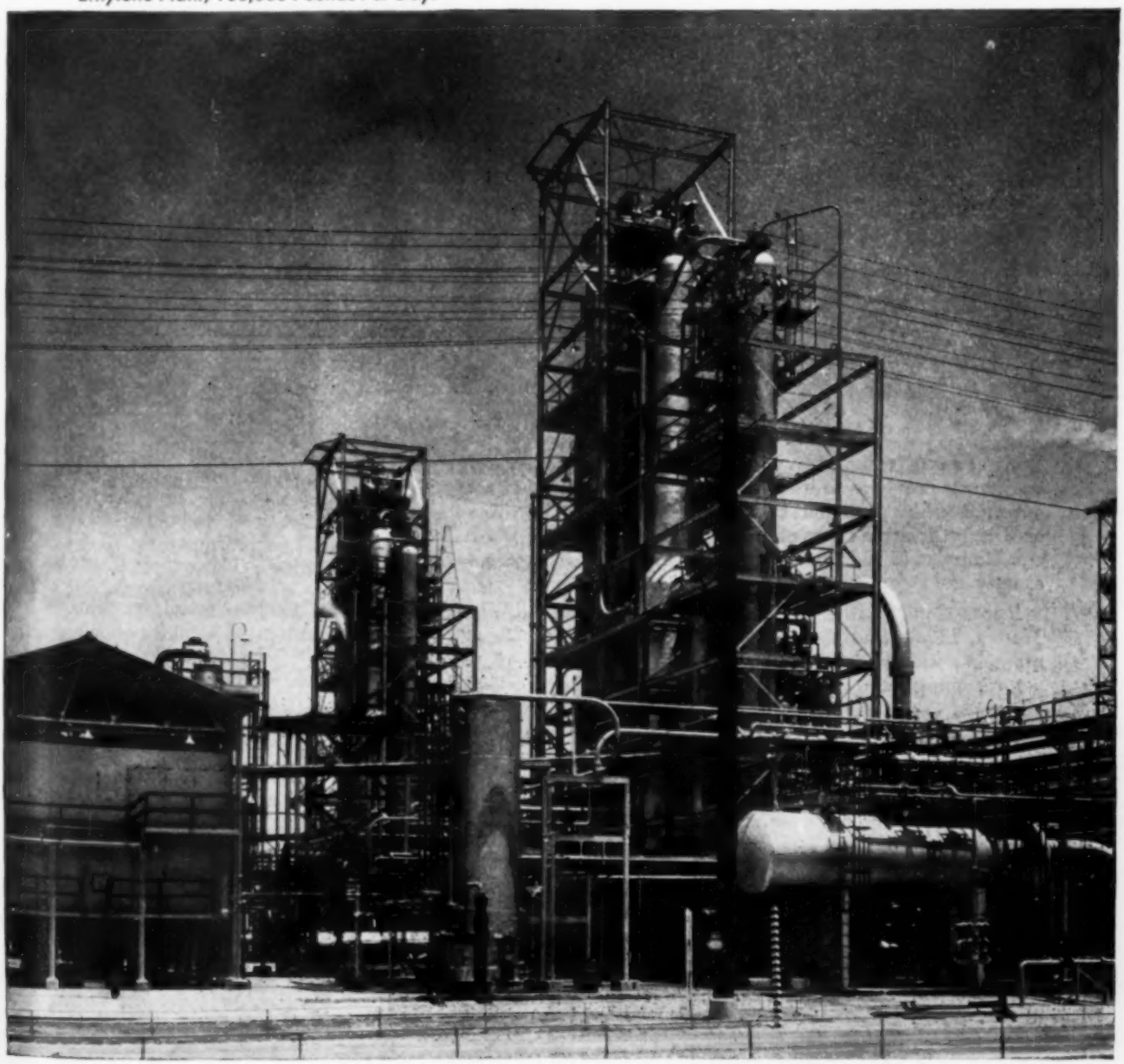
THE LUMMUS COMPANY
420 Lexington Avenue, New York 17, N.Y.

LUMMUS

CHICAGO—600 South Michigan Avenue, Chicago 5, Ill.
HOUSTON—Mellie Esperson Bldg., Houston 2, Texas
LONDON—78 Mount Street, London, W. 1, England

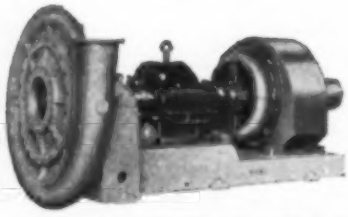
— an integrated service extending from engineering surveys of existing facilities and economic studies to the design, construction and initial operation of chemical process units and chemical manufacturing plants.

Ethylene Plant, 100,000 Pounds Per Day.



PLUS-VALUE ASSURED

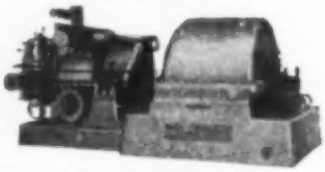
Special design Rotary unit for scavenging Diesel engine



Single-stage Centrifugal Blower

Rotary Positive Gas Pump

Positive Displacement Meter



Multi-stage Centrifugal Blower

Small Rotary Positive Blower for separate or built-in mounting

WITH

R-C equipment

You get a plus-value when you bring your air or gas handling equipment problems to Roots-Connersville. That's because of our *dual-ability* to engineer and build either the Centrifugal or Rotary Positive types of Blowers, Exhausters and Boosters. Completely independent thinking permits us to supply exactly the right unit for your needs.

Roots-Connersville also builds Positive Displacement Meters, Liquid and Vacuum Pumps and Inert Gas Generators, in a wide variety of sizes and types. Our long experience assures completely satisfactory performance, resulting from advanced engineering plus precision workmanship.

For intelligent answers to your equipment problems, you can depend upon Roots-Connersville know-how.

ROOTS-CONNERSVILLE BLOWER CORPORATION
711 Illinois Avenue, Connersville, Indiana

ROOTS-CONNERSVILLE ROTARY CENTRIFUGAL

BLOWER BUILDERS R-C SINCE 1854

BLOWERS · EXHAUSTERS · BOOSTERS · LIQUID AND VACUUM PUMPS · METERS · INERT GAS GENERATORS

• • ONE OF THE DRESSER INDUSTRIES • •

conditions. In this way it keeps moisture and other corrosive agents from reaching the surface and provides protection from within as well as from without. Drying is a matter of minutes. Prufcoat Aluminum comes ready mixed and does not settle appreciably.

57. DDT Insecticides

Two NEW DDT insecticides are being manufactured by Boyle-Midway Inc., New York. Black Flag 25 percent DDT Emulsion Concentrate and Black Flag 50 percent DDT Wettable Powder both contain a harmless dye which tints the mixed solutions a pale blue. This will prevent them from being mistaken for milk. They may be used as live-stock sprays or cattle dips and as residual type sprays for use in barns and other buildings. Both are equally effective against insects found on many types of plants. The Emulsion Concentrate is water emulsifiable which makes it safer than kerosene-base insecticides for use around plants and animals. The Wettable Powder is water dispersible which makes it effective in controlling lice.

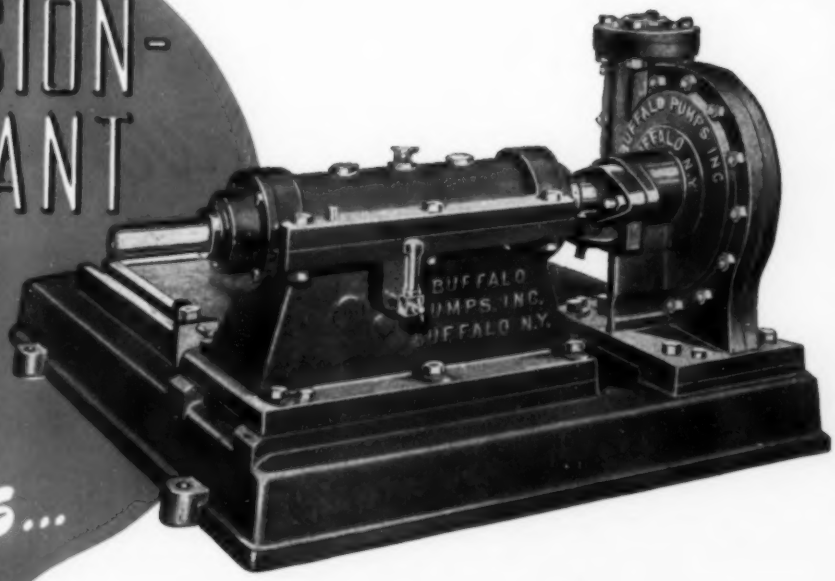
58. Polyethylene Tubing

FLAT, SEAMLESS polyethylene tubing is now being made by the Plax Corp., 133 Walnut St., Hartford, Conn. Designed for use in the packaging field, it will provide a wrapper which needs to be sealed only at the two ends. Plax Polyethylene Layflat Tubing may be cold-stretched several hundred percent and wrapped tightly without tearing. It has the same wax-like translucency as Polyethylene. Resistant to fats and oils at room temperature, it is non-toxic, tasteless and odorless. The tubing is sold in continuous lengths with diameters ranging from 2½ in. to 27 in. with ½ in. gradations. Thicknesses range from 0.0015 in. to 0.01 in. with gradations of 0.0005 in.

59. Adhesive

DEVELOPED specifically for brake lining use by the B. F. Goodrich Co., Akron, Ohio, is Plastilock 601. An entirely synthetic product, the formula and basic ingredient have not been made public yet. The adhesive is to be used for anchoring automotive brake linings in place of the usual brass rivets. Said to eliminate all danger of rivet-scoring of brake drums, it will allow the brake lining to be worn down to the shoe before replacement is necessary. Tests conducted

CORROSION-RESISTANT *to these liquids...*



Liquid	Conditions	Materials Permissible
Acid, Sulphuric	to 50%	Lead, 5, High Silicon Iron
Aluminum Sulfurous		Lead, Sulphite, Bronze, Alum. Bronze, 4, 5
Aluminum Sulphate (Alum)	Containing Water & Acid	Lead, High Silicon Iron, 5
Ammonium Sulfate	With H_2SO_4	Lead, All Bronze, 5
Chloroform		Lead, 3, 4, 5
Copper Sulfate, Blue Vitriol	Aqueous Sol.	Lead, 3, 4, 5, High Silicon Iron
Ethylene Chloride	Cold	Lead, 5, High Silicon Iron
Ferrous Sulphate (Copperas)	Aqueous Sol.	All Iron, Lead, 5, High Silicon Iron
Magnesium Chloride	Aqueous Sol.	Lead, High Silicon Iron, 5 (Cold)
Sodium Bisulfate	Aqueous Sol.	5, Lead, High Silicon Iron
Sodium Hydrosulfite	Aqueous Sol.	Lead, 3, 4, 5
Sodium Hypochlorite		5, Lead, High Silicon Iron, Non-Metallic
Sodium Sulfide	Aqueous Sol.	All Iron, All Bronze, Lead, 3, 4, 5
Sodium Sulfite	Aqueous Sol.	All Bronze, Lead, 3, 4, 5
Sodium Thiosulfate	Aqueous Sol.	3, 4, 5, Monel, Lead, High Silicon Iron, Non-Metallic
Sulfur Chloride	Cold	All Iron, Lead
Zinc Electrolyte		Lead, 5, High Silicon Iron

*** Extract from STANDARDS OF HYDRAULIC INSTITUTE, Data Section**
For complete table, simply write us for bulletin 982.

● Do you handle any of the liquids indicated at right? Then you'll find a "Buffalo" Lead Acid Pump the answer to corrosion problems!

"Buffalo" Lead pumps are handling hot or cold sulphuric acid, alum, ammonium sulphate and copper sulphate very successfully in many chemical installations. Their three-inch-deep stuffing boxes; extra heavy casing walls and shells; oversize shafts and bearings; absence of close running tolerances mean high efficiencies and extra long life.

Also available in all iron or special alloys.

Why not write us concerning your pumping problem. We may well be able to solve it for you and save you money.

BUFFALO PUMPS, INC.

501 BROADWAY BUFFALO, N. Y.

Canada Pumps Ltd., Kitchener, Ont.

"Buffalo" LEAD ACID PUMPS

Material Handling at First U. S. Tin Plant

-built around BAKER TRUCKS

"After four years operation Baker Fork Trucks continue satisfactory... in our Texas City Plant"
Tin Processing Corporation

Bagged ore, palletized at wharf, is loaded onto flat car by Baker Fork Truck. Another Baker Truck unloads and stores pallet-type crates at the plant.

The continuous operation of the Tin Processing Corporation's Texas City plant—largest tin smelter in the Western Hemisphere—built to meet our war requirements—depends on the durable and reliable service of a fleet of Baker Trucks.

Ore arrives by vessel in 100 lb. bags, which are palletized at the wharf and loaded by a Baker Fork Truck onto flat cars, for transportation to the plant. Here another truck unloads and stores the pallet type crates.

As ore is needed, a fork truck carries a crate to the mixing hopper, placing it on a raised deck, from which bags are emptied into the hopper. After crushing and purification, ores go to the smelter for reduction to metal and casting into bars. Stacks of bars weighing 4,000 lbs. are carried by truck to storage and later to box cars for shipment.

Positioning crate of ore on raised deck alongside hoppers of crushing machine.

Besides Baker Fork Trucks, the plant uses a Baker Hopper Truck with built-in scale for measuring batches going to smelting furnaces.

Management and maintenance men are enthusiastic about the trucks—particularly because of their excellent service under the difficult operating conditions caused by the relatively fine and gritty nature of the ore handled.

Let a Baker Material Handling Engineer show you how to improve your production efficiency.

See us at Booth 303
Materials Handling Exposition
Cleveland, January 12-16

BAKER INDUSTRIAL TRUCK DIVISION
of The Baker-Raulang Co.
2145 West 25th Street • Cleveland 13, Ohio
In Canada: Railway & Power Engineering Corp., Ltd.

Baker INDUSTRIAL TRUCKS

by an interested automotive concern showed that while rivets start to shear at 3,500 lb. and fail at 5,000, lining attached by the new adhesive holds fast until 11,000 lb. of shearing pull are applied. It requires a severe curing period of applied heat and pressure. The material will be available soon in either tape or liquid form.

60. Moisture Resistant Resin

FOR THE TREATMENT of huge quantities of insect netting used in the South Pacific during the war, the American Cyanamid, 30 Rockefeller Plaza, New York, N. Y., developed a moisture resistant finish. A refined form of this resin is now being marketed for imparting crispness and shimmering qualities to nylon tulle, cotton and rayon.

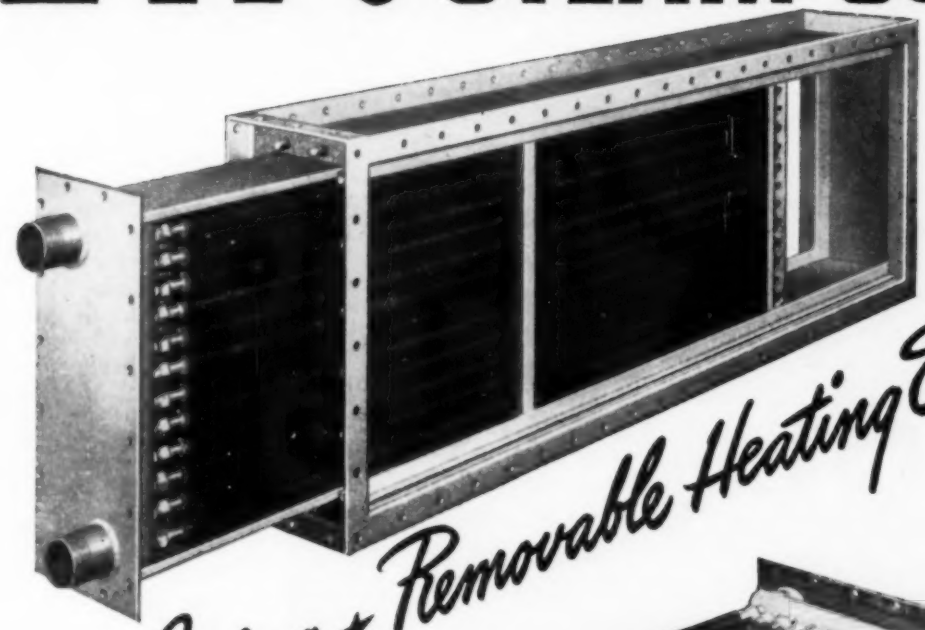
61. Paint Ingredient

PRODUCTION of Pentek has been doubled in recent months. Incorporated in the ingredients of paints, enamels and varnishes at the time of manufacture, its purpose is to replace the glycerine found in the natural oils used in making these finishes. Developed by the Heyden Chemical Corp., Garfield, N. J., this commercial version of pentaerythritol, an alcohol derived from formaldehyde, is said to have great wear and mar resistance, glass and color retention, quick drying properties and water and alkali resistance. Extensively tested for uses by the manufacturer, it is recommended for use in finishes for fences, shutters, exterior woodwork, floors and metal.

62. Plasticizers

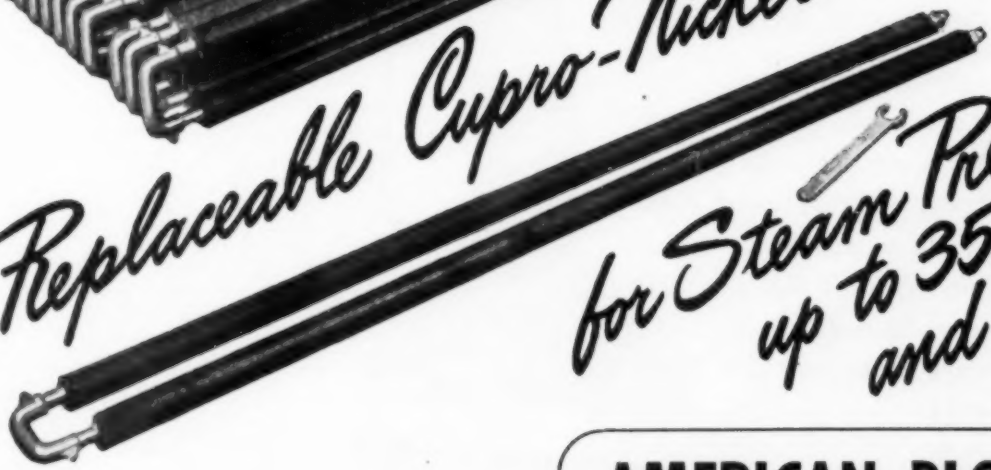
TWO NEW plasticizers for polyvinyl chloride and copolymers have been developed by the Resinous Products and Chemical Co., Washington Square, Philadelphia 5, Pa. Monoplex 11, the dialkyl ester of a synthetic long chain dibasic acid, is used in polyvinyl chloride stocks with good low temperature and ultra-violet resistant properties, low volatility and excellent solvating action. It is claimed that stocks plasticized with Monoplex 11 have excellent hand and drape. It is particularly suitable for high pigment loading uses where the retention of flexibility and resistance to abrasion are important. Monoplex 16, a high molecular weight nitrile plasticizer is said to yield polyvinyl chloride stocks of superior heat and ultra-violet stability, permanence, good low temperature flexibility and low water sensitivity. The relationship of temperature to solvating action of

NEW! HEAVY DUTY STEAM COILS



Air Tight Casing ★ Removable Heating Element

Replaceable Cupro-Nickel Tubes



for Steam Pressures up to 350 lbs. and 600°F.

AMERICAN BLOWER

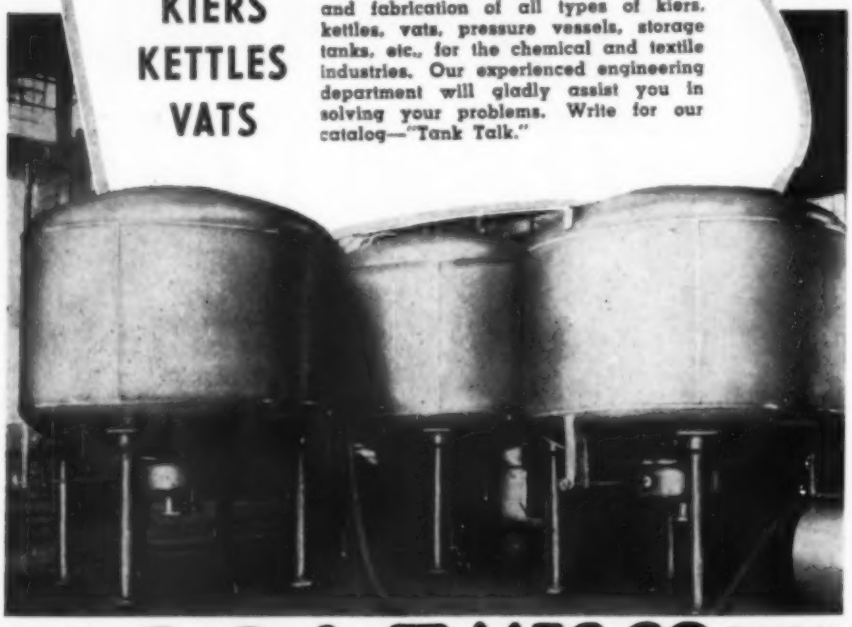
Division of American Radiator & Standard Sanitary Corporation

Write for Bulletin No. B-1318

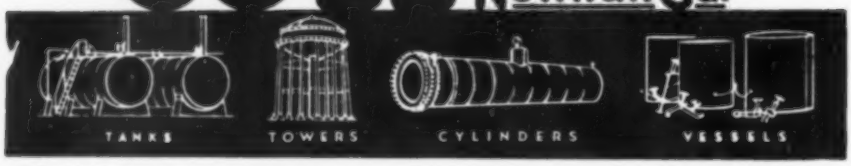
AMERICAN BLOWER CORPORATION, DETROIT 32, MICH.
In Canada: CANADIAN SIROCCO CO., LTD., WINDSOR, ONT.

KIERS
KETTLES
VATS

We are widely experienced in the design and fabrication of all types of kiers, kettles, vats, pressure vessels, storage tanks, etc., for the chemical and textile industries. Our experienced engineering department will gladly assist you in solving your problems. Write for our catalog—"Tank Talk."



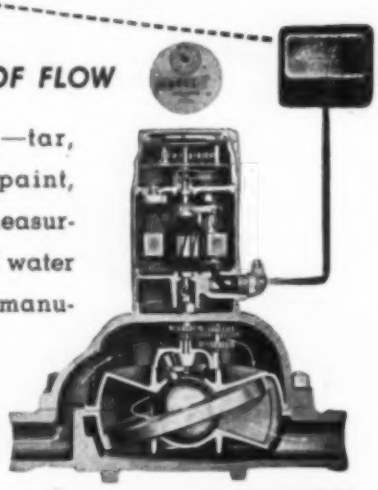
R.D. COLE MFG. CO. ESTABLISHED 1869
Newnan Ga.



NEW

HAYS Veriflow
TOTALIZING-INDICATING
METER

Featuring
REMOTE INDICATION OF RATE OF FLOW



For practically all liquids—tar, molasses, crude oil, grease, paint, varnish, syrups, etc., etc.—for measuring, indicating, totalizing flow of water and chemicals in continuous manufacturing processes and numerous other uses. Its remote indicating feature is new—get the complete story.

SEND
FOR
BULLETIN
46-766

The HAYS CORPORATION
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

Monoplex 16 suits it for dispersion compounding. Both plasticizers are compatible with such elastomers as Neoprene, nitrile rubber and polyvinyl butyral, and in film formers such as cellulose aceto butyrate. This quality suggests their use as free film for rainwear, shower curtains, upholstery, luggage and in coated fabric.

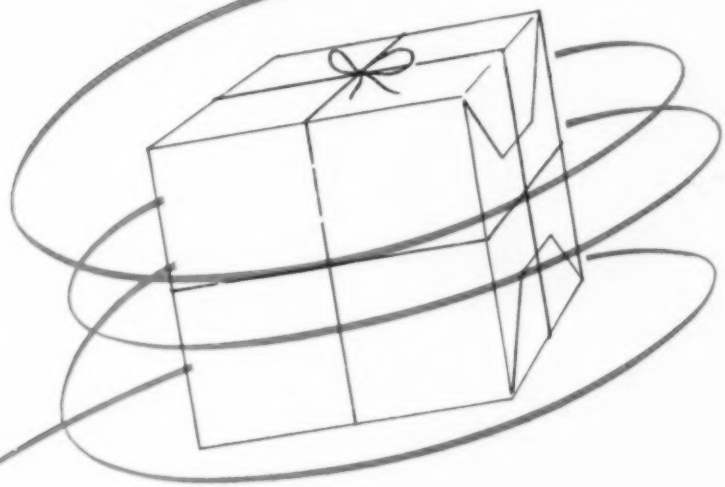
63. Stiffening Agent

A HIGH styrene, low butadiene copolymer called Good-rite Resin 50 is now being produced in commercial quantities by the B. F. Goodrich Co., Rose Building, Cleveland 15, Ohio. Specifically developed for use as a stiffening agent for synthetic shoe soles, tests made by the manufacturer now indicate that it is well adapted for electrical insulation, protective coatings and for molded items such as injection molded appliance plugs. Sold as a white powder, Good-rite Resin 50 has a specific gravity of 1.045. It may be softened and sheeted on a mill at temperatures of 150 to 225 deg. F. Using a 45 second molding cycle, it may be injection molded at temperatures of 380 to 440 deg. F. Good resistance to impact and water absorption, increased hardness and good electrical properties are some of the characteristics that this new resin imparts to natural and synthetic rubbers. When used in small amounts, as a compounding ingredient for GR-S or natural rubber, Good-rite resin is said to give increased abrasion resistance to cut growth up to certain limits. Hysteresis and compression set are generally increased while rebound is decreased.

64. Coating for Aluminum

A THIN, tough skin for corrosion-proofing and anchoring paint on aluminum may now be applied through the use of Alodine. Developed by the American Chemical Paint Co., Ambler, Pa., Alodizing is essentially a chemical process. It combines the advantages of electrolytic and non-electrolytic methods of coating and is to be more economical of time and money than either. By spraying or immersing aluminum for two minutes in a chemical solution heated to a temperature no higher than 120 deg., it is claimed that the clean, unoiled metal may be treated so that it holds paint without a priming coat. Furthermore it will withstand bending, denting, abrasion and corrosion even from a salt spray. An extra sealing stage, indispensable in other processes, is eliminated. Drying is necessary if the work is to be exposed unpainted, or rinsing if the work is to be painted

In WEST VIRGINIA



All the Basic Requirements of the Vast and Growing Chemical Industry are found in ONE PACKAGE!

For all types of industry WEST VIRGINIA offers an ideal geographical position—within overnight reach of the great markets of the east and middle west—midway between north and south. Transportation is by rail, water, highway and air. Here is one of the few areas in the nation with a surplus of high-quality labor—men and women who know how to use both heads and hands.

More specifically, WEST VIRGINIA is an ideal location for the immense, growing field of chemical production. The state is the largest source of natural gas east of the Mississippi River. It is the nation's leading producer of low-cost, high-quality bituminous coal. Electric power for industrial purposes is ample. Natural brines and virtually inexhaustible beds of rock salt are found over a wide area. It is not by chance that many of the great names in chemistry —American Cyanamid, Barium Reduction, Carbide and Carbon, DuPont, Monsanto, National Carbon, Ohio Apex, Pittsburgh Plate Glass, Standard Ultramarine, United States Rubber—have turned and are still turning to this state which produces in one package all the basic requirements of this vast and growing industry.

Important also is the fact that WEST VIRGINIA is not crowded by industry. In WEST VIRGINIA there is room to build that big, new plant; and there's room, too, for the largest to grow larger.

Executives are invited to investigate the opportunities offered the chemical industry by the State of WEST VIRGINIA. They will find state and local officials, communities and the people who compose them, fully cooperative.

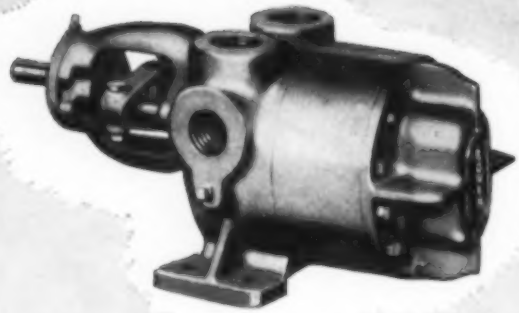
Write today for a FREE copy of the New Handbook of Facts about West Virginia . . .

WEST VIRGINIA

INDUSTRIAL & PUBLICITY COMMISSION

CHARLESTON 5 • WEST VIRGINIA

Proved Roper Features
that insure
DEPENDABILITY



✓ Hydraulic self-lubricating principle prolongs pump life with less service attention. There is positive continuous bearing lubrication. Liquid pumped enters grooved bearings from pressure side, is drawn to suction side through grooves in opposite bearings.

✓ Floating equal size external gears, oversize bearings with gears supported at both ends, packed box or mechanical seal units to suit individual job requirements, efficient operation in either direction, easy accessibility to working parts cuts down "out-of-service" time.

✓ Four-port design offering eight optional piping connections cuts installation time and cost. Four piping arrangements are possible with pump operating clockwise . . . 4 other arrangements with pump operating counter-clockwise.

WIDE RANGE OF SIZES

Capacities ¾ to 300 g.p.m. — pressures up to 1000 p.s.i. — speeds up 1800 r.p.m.

Send for Bulletin of Facts Today

ROPER
Rotary Pumps

GEO. D. ROPER CORP., 151 Blackhawk Park Ave., Rockford, Ill.

or waxed. Aluminum awnings, aircraft and aircraft parts, truck panels, metal tiles, venetian blind slats, outboard motors, cabinets and furniture all suggest possible uses of Alodine.

65. Cellulose Ester Plastic

FOR INJECTION molding and continuous extrusion, the Tennessee Eastman Corp., Kingsport, Tenn., is now manufacturing the third in a series of cellulose ester plastics, Tenite III. Offered in pellet and granular form, this cellulose acetate proprionate plastic has high impact strength at both ordinary and low temperatures. It is said that good dimensional stability, wide temperature range and minimum odor greatly increase the adaptability of the Tenite group. They are obtainable in plain colors, metallic pearls, special grade blacks, variegations and regular grade black.

66. Plasticizing Resin

ANOTHER plasticizer, the latest in a series of alkyd-type, polymeric plasticizing resins, also has been announced by this company. Intended for use with nitrocellulose, urea and melamine resins, Paraplex RG-10 is a light colored, oil-modified Polyester said to have improved alcohol tolerance, greater solvency for nitrocellulose, unusual pigment stability and increased adhesion to vulcanized rubber. It is resistant to ultra violet light and does not spew at temperatures as high as 325 deg. F.

67. Water Shedding Film

FOR DISPLACING water from the surface of metals, a thin mobile liquid called Hydrex has been announced by Ethone, Inc., 442 Elm St., New Haven, Conn. It is recommended for drying of plated work to prevent staining or spotting. Plate work, such as chromium, silver or cadmium is agitated in the liquid and the water sinks to the bottom. The work is removed and the Hydrex left to evaporate. An almost imperceptable film which is somewhat rust resistant remains on the surface. If the film is objectionable it may be removed by Stoddard solvent or a vapor degreaser. Hydrex comes in two forms, No. 1 and No. 2. The former has a flash point of 100 deg. F. while the flash point of the latter is above 150 deg. F. causing slower drying. The prices for No. 1 are: 1 gal. container, $2 per gal.; 5 gal. container, $1.35 per gal.; 55 gal. drum, $1.10 per gal. For No. 2, a 1 gal. container is $2; 5 gal. container $1.50 per gal.; 55 gal. container, $1.25 per gal.

CHEMICAL ENGINEERING NEWS

Richard F. Warren, ASSISTANT EDITOR

SCI Medal Awarded to George W. Merck

ON November 7 the American Section of the Society of Chemical Industry honored George W. Merck, president of Merck & Co., Inc., by awarding him the Chemical Industry Medal for 1947. The medal was presented at a dinner in New York by past chairman Sidney D. Kirkpatrick. Addresses were made by John P. Marquand, author; Dr. A. N. Richards, vice-president in charge of medical affairs of the University of Pennsylvania; and Mr. Merck.

George W. Merck

In his discussion, Mr. Merck emphasized teamwork between scientific, technical personnel and management. He pointed out that management must prepare the soil in which research can flourish. It must provide not only the tools and equipment, but also conditions of work satisfactory to the individual. Management must strive to aid the scientific and technical men to develop their potentialities and win deserved recognition. Most important of all, according to Mr. Merck, management must contribute vision and courage, as well as sound organization and over-all business judgment.

Consultants Elect Molnar President

AT THE annual meeting of the Association of Consulting Chemists and Chemical Engineers held in New York in October, election of the new officers was announced as follows: president, Nicholas M. Molnar; vice president, A. Taub; secretary, M. F. Lauro; and treasurer, P. F. Wehmer.

Diamond Expanding Its Alkali Output

MARKETING of a broad list of products is planned by Diamond Alkali Co. when its $12 million chlorine-caustic plant near Houston, Tex., is completed next year. Full capacity chlorine production will amount to over 200 tons per day. Caustic soda will be supplied in the usual 50 percent concentration as well as 73 percent strength and solid caustic. In view of the location of the plant on the Houston Ship Channel it is intended that heavy shipments of solid caustic will move by water into world markets. Diamond will be able to move chlorine and caustic by pipeline from the Houston plant to the nearby Shell Chemical and Shell Oil Co. plants.

Facilities are being provided to produce aqueous muriatic acid, although only a nominal amount probably will be made. A special form of flake caustic soda with phosphate content will be manufactured for the bottle washing trade. Byproduct evaporated salt will also be offered. Chlorine will be shipped in single unit tank cars, multiple unit cars and 150-lb. cylinders. Eventually equipment will be installed to utilize chlorine in the manufacture of other chemicals.

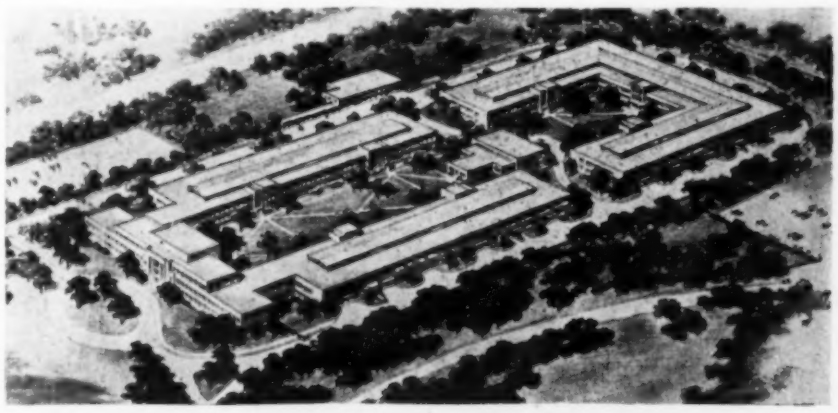
The company expects to continue operation of the government-owned caustic-chlorine plant at Pine Bluff, Ark., after production begins at Houston. Caustic from Houston will augment that which is being moved from Pine Bluff to the company's plant at Dallas which is producing sodium metasilicate.

Diamond Alkali's general headquarters at Pittsburgh will be moved to Cleveland, Ohio, next spring.

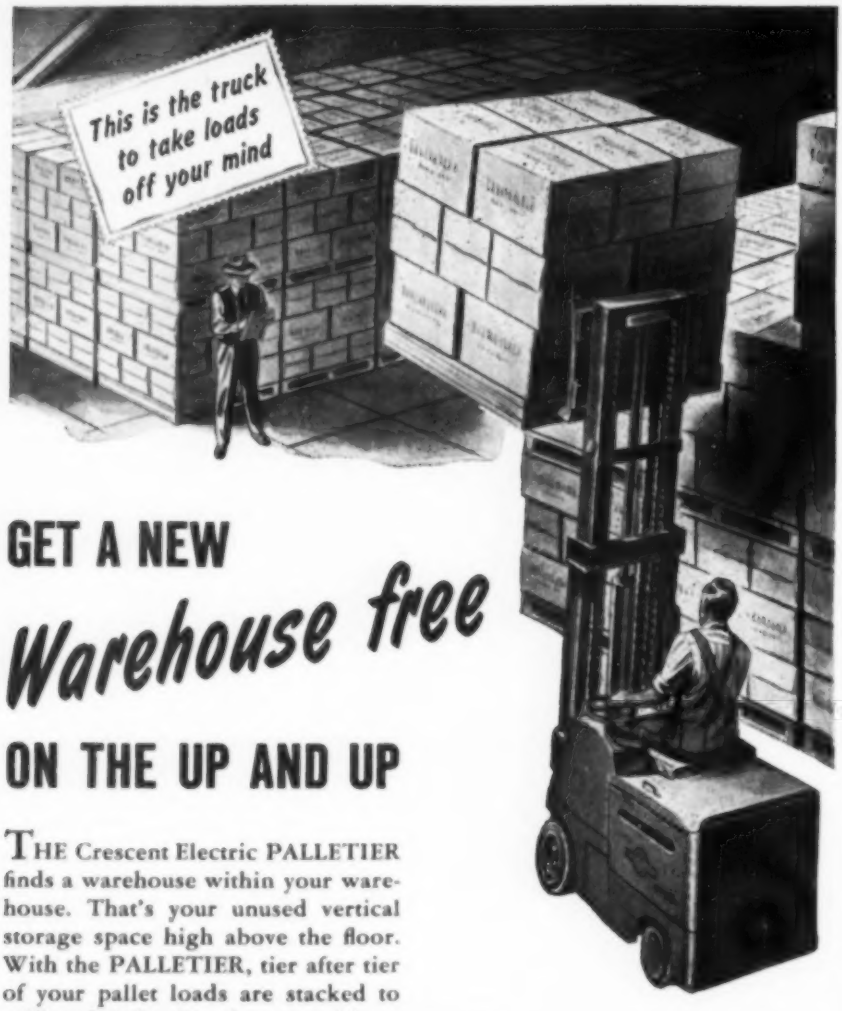
Portland Firm Makes New Ion Exchange Resins

AFTER more than 17 months research and pilot work Zehrung Chemical Co., Portland, is marketing two new synthetic cation exchange resins of the phenolaldehyde type, and expects shortly to offer a new anion absorbent resin. A pilot plant built in October 1946 has been shaken down into a small production unit capable of producing approximately 4,000 cu. ft. of resin monthly. Plant enlargements are planned to coincide with increased demand. In addition to many potential uses, the resins are of value in water softening, sugar purification, metal disposal and recovery and in the purification of amino acids.

All but one of the raw materials are being supplied by western sources. Phenol is obtained from Reilly Tar & Chemical Co., Provo, Utah, and form-



First unit (center foreground) of this Johns-Manville Corp. research center at Manville, N. J., has been completed. Cornerstone of the second (far left) unit was laid in October. The center is part of a $50 million expansion program



GET A NEW

Warehouse free

ON THE UP AND UP

THE Crescent Electric PALLETIER finds a warehouse within your warehouse. That's your unused vertical storage space high above the floor. With the PALLETIER, tier after tier of your pallet loads are stacked to ceiling height. Up they go without heave ho . . . safely, speedily.

Your loading and unloading time shrinks to a minimum. Up steep ramps, down narrow aisles travels the maneuverable, power-packed PALLETIER. Low in initial cost, low in maintenance costs, it soon pays for itself by slashing your handling costs.

Send for free bulletins illustrating and listing Specifications for 1000, 2000, 3000 and 4000-pound Crescent Electric PALLETIERS.

CRESCENT TRUCK COMPANY
1115 Willow St., Lebanon, Pa.

Industrial Truck and Tractor Specialists Since 1917

FIVE IMPORTANT FEATURES

Only the PALLETIER Has Them All

- **Full Magnetic Contactor Control** protects against forced acceleration—extends life of motor and tires.
- **Complete Stability** with load fully elevated and tilted forward.
- **Battery Power** eliminates fumes and fire hazard.
- **Full Accessibility** to all mechanisms for easy inspection and maintenance.
- **Maximum Visibility**—operator spots and tiers without stirring from seat.

Crescent
ELECTRIC
PALLETIER
REG. U. S. PAT. OFF.

aldehyde from the Springfield, Ore., plant of Casein Corp. of America. Raw materials are fed through rotameters into a continuous mixer equipped with means for cooling the liquid resin, thence into a circular-type, gas heated oven. During one complete revolution of the oven the resin changes from liquid to the fully cured or polymerized state. It is afterwards ground and screened. Although designed for continuous operation on one cation resin, the unit has been altered slightly to permit batch operations on the second as well.

General Chemical Building Sulphuric Acid Plant

IN LINE with a general trend to increase sulphuric acid capacity, General Chemical Co., New York, subsidiary of Allied Chemical & Dye Corp., has announced the purchase of a 50-acre parcel on the Kanawha River at Nitro, W. Va., as a site for a new sulphuric

CONVENTION CALENDAR

National Association of Insecticide & Disinfectant Manufacturers, Lord Baltimore Hotel, Baltimore, Md., December 1-3.

Exposition of Chemical Industries, 21st exposition, Grand Central Palace, New York, N. Y., December 1-6.

National Association of Corrosion Engineers and corrosion division of the Electrochemical Society, cathodic protection symposium, William Penn Hotel, Pittsburgh, Pa., December 8-10.

Association of American Soap and Glycerine Producers, Waldorf-Astoria Hotel, New York, January 28-29.

National Materials Handling Exposition, Public Auditorium, Cleveland, Ohio, January 12-16.

American Society of Heating & Ventilating Engineers, eighth international heating and ventilating exposition, Grand Central Palace, New York, N. Y., February 2-6.

American Institute of Chemical Engineers, regional meeting, New Orleans, La., February 15-19.

Technical Association of the Pulp and Paper Industry, national meeting, Hotel Commodore, New York, N. Y., February 23-26.

National Association of Corrosion Engineers, fourth annual conference, Jefferson Hotel, St. Louis, Mo., April 5-8.

American Chemical Society, 113th national meeting, Chicago, Ill., April 19-23.

WHEN IS A TANK CAR NOT A TANK CAR?

The answer: *never!* A tank car is *always* a tank car. But even if all tank cars look alike—as all cats look grey in the dark—there are important differences under the tank car's workaday coat of paint.

In the GATX fleet of 37,000 specialized tank cars, there are 207 types. Designed not just for the fun of it—but for the practical purpose of supplying you, the shipper, with the right car for your particular commodity.

Routing cars from one season to another . . . from one commodity to another . . . from one part of the country to another is part of the job General American does for its customers—the railroads and the shippers. A basic service of those hard-working tank cars with the GATX reporting mark.

GENERAL AMERICAN TRANSPORTATION CORPORATION

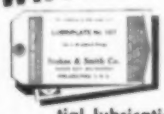
135 South La Salle Street, Chicago

DISTRICT OFFICES: Buffalo • Cleveland • Dallas • Houston • Los Angeles • New Orleans
New York • Pittsburgh • St. Louis • San Francisco • Seattle • Tulsa • Washington
EXPORT DEPT.: 10 East 49th Street, New York 17, New York

GATX
GENERAL AMERICAN

NOW

WHO'LL LUBRICATE IT?



The LUBRIPLATE Tag Service assures the machinery manufacturer, who uses LUBRIPLATE for initial lubrication, that the machines will be serviced with the same outstanding lubricant. Machine Builders, use the Tag Plan. Machine users, mail the post cards you find on the equipment.

℞ FOR YOUR MACHINERY

No. 2 — Ideal for general oil type lubrication, ring oiled bearings, wick feeds, sight feeds and bottle oilers.

No. 8 — Because of high film strength and long life it reflects outstanding performance in most types of enclosed gears (speed reducers).

No. 107 — One of the most popular grease type products for general application by pressure gun or cups.

No. 70 — For a wide range of grease applications, especially at temperatures above 200 degrees F.

No. 130-AA — Known nationwide as the superior lubricant for open gears, heavy duty bearings, wire rope, etc.

BALL BEARING — This is the LUBRIPLATE Lubricant that has achieved wide acclaim for use in the general run of ball and roller bearings operating at speeds to 5000 RPM and temperatures up to 300 degrees F.

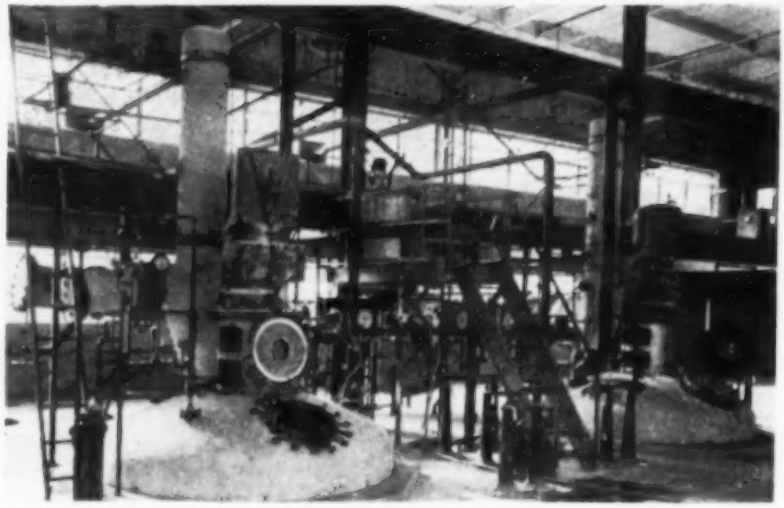
LUBRIPLATE

FISKE BROTHERS REFINING CO.

NEWARK 5, N. J. TOLEDO 3, OHIO

DEALERS FROM COAST TO COAST

CONSULT YOUR CLASSIFIED TELEPHONE BOOK



These 30,000 lb. resin kettles are part of the new coating resin plant of Plaskon Division, Libbey-Owens-Ford Glass Co., located in Toledo. The plant is in preliminary operation and full scale production will be under way before the end of the year. It will make phenol formaldehyde, urea formaldehyde, maleates, ester gums, and specialty resins. Accurate charging of the kettles is assured by the scale type raw material handling equipment

acid plant. Construction of acid facilities has started. The unit is expected to be in production by early spring. The plant, to be known as Nitro Works, will serve the Charleston, W. Va., area. Acid shipments will be made by barge and rail.

Carborundum Buys Surplus Buffalo Plant

THE CARBORUNDUM CO. has received the WAA preliminary notification that its bid of $1 million for a part of Plancor 168, formerly operated by Bell Aircraft Corp. has been accepted. The property comprises approximately 65 acres. It is located at the northeast corner of the original Bell property fronting on Walmore Road, Buffalo, N. Y. Included in the purchase are four buildings with a total floor area of 290,000 square feet. It has been acquired primarily as a manufacturing space for the coated products division of the Carborundum Co. Extensive renovation is planned to start immediately in conformity with engineering programs already completed, to be made effective when and if the bid was accepted by the government.

AIChE Holds Regional Meeting in Buffalo

BUFFALO played host to the latest regional meeting of the AIChE, held at the Statler Hotel from September 28 to October 1. The Niagara-Buffalo region provided an excellent opportunity for a first hand examination of many different phases of the chemical process industries, and the various companies in that area were very cooperative in arranging plant trips for members attending the meeting.

The Institute presented papers on developments and applications in high concentration hydrogen peroxide, elimination of corrosive phenol waste liquors through the use of NaCl and high pressure distillation, and chlorine absorption in water and its application to design of bleach manufacturing equipment for pulp mills. Use of activated carbon to reduce operating costs through the recovery of solvent vapors, rate of equilibrium approach and its effect on operation of fractionating columns, and nine papers on fluid flow were also among the papers presented.

Atomic Power Timetable Shows No Near Industrial Uses

TODAY'S economic planning need take little account of atomic power possibilities according to Chairman Lilienthal of the Atomic Energy Commission. Here is Mr. Lilienthal's new nuclear power timetable: (1) Production of electricity on a pilot plant scale of about a thousand kilowatts—18 to 24 months. (2) Large-scale production of electricity in a "useful practical demonstration plant—eight to ten years." (3) Atomic energy supply 10-20 percent of the country's power needs—"around two corners."

This is a more pessimistic view than was prevalent six month ago when most people concerned with the project felt that the first commercial power plants were about five years away.

Symbols of *Quality*

This is the sixty-first birthday of The Society of the Sigma Xi, Scientific Research Society of America. Down through the decades, its Greek letter-key has become symbolic of the highest ideals of the scientific world.

Baker & Adamson is equally proud that for a like number of years it, too, has been serving American sciences—particularly in the field of chemistry. In each generation, B&A Reagents have gained the full confidence of industrial and research chemists alike.

Today, Baker & Adamson continues to serve . . . and to set the pace in chemical purity . . . just as it has since 1882. The B&A "Shield of Quality" identifying its products is accepted throughout the chemical world as a symbol signifying highest quality, purity and uniformity in laboratory chemicals.

To B&A, such recognition in the past is a responsibility to be upheld in the future.

REAGENTS
B&A
STANDARD OF PURITY
FINE CHEMICALS

GENERAL CHEMICAL COMPANY
BAKER & ADAMSON DIVISION

40 RECTOR STREET, NEW YORK 6, N. Y.

Sales and Technical Service Offices: Albany* • Atlanta • Baltimore • Birmingham* • Boston* • Bridgeport Buffalo* • Charlotte* • Chicago* • Cleveland* • Denver* • Detroit* • Houston • Kansas City Los Angeles* • Minneapolis • New York* • Philadelphia* • Pittsburgh* • Portland (Ore.) • Providence* St. Louis* • San Francisco* • Seattle • Wenatchee (Wash.) • Yakima (Wash.)
In Wisconsin: General Chemical Wisconsin Corporation, Milwaukee, Wis.
In Canada: The Nichols Chemical Company, Limited • Montreal* • Toronto* • Vancouver*

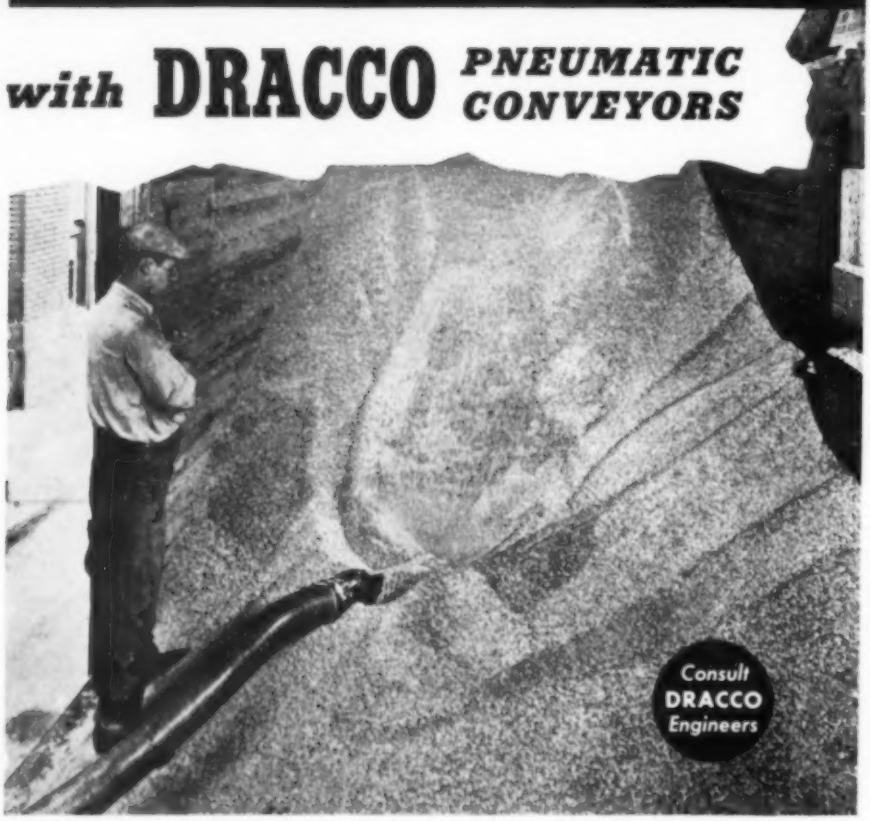
SETTING THE PACE IN CHEMICAL PURITY SINCE 1882

*Complete stocks carried here.

Reduce LABOR Costs

Increase material handling efficiency

with **DRACCO** ***PNEUMATIC CONVEYORS***



Material handling costs can be reduced in many plants. DRACCO Pneumatic Conveyors move chemicals, grains and granular materials with a minimum of manual labor — ONE man and a DRACCO Pneumatic Conveyor invariably replaces SEVERAL men. Materials are moved more efficiently and cheaper — with fewer man hours. Why not let DRACCO Engineers check your present material handling methods with a view of recommending a BETTER method requiring LESS labor. They have over 30 years of experience in material handling.

For Further Information Write

DRACCO CORPORATION

4071 E. 116th St., Cleveland 5, Ohio *New York Office* 130 W. 42nd St.

DUST CONTROL EQUIPMENT
PNEUMATIC CONVEYORS • METAL FABRICATION

Lilienthal accounts for the longer timespan by pointing to the technical difficulties involved in successful power production. The most serious problems are chemical. Periodically, fission products must be separated from the still unconsumed fissionable material to keep the pile running. He says that major problems in power generation are still at university research levels and have not reached the engineering investigation stage. AEC's engineering job is now the rebuilding and expanding of plutonium production works at Hanford and elsewhere.

Partial relegation of power studies to academic groups is interpreted as a move to free nuclear and chemical engineering talent for the big job involved in rebuilding the production plants for maximum output of explosive materials.

Group Studies Plan for a New Arkansas Superphosphate Unit

DECISION to build facilities to manufacture superphosphate and mixed fertilizers has been reached by the Arkansas Farm Bureau Cooperative. The agency has engaged the Research and Service Division of the Farm Credit Administration to determine a suitable site for the plant and estimate the probable costs involved. An official of the cooperative says that the manufacturing capacity of the project will be determined on the basis of the survey.

The Arkansas cooperative does not have at present any fertilizer manufacturing plant, according to its representatives in Little Rock. The subject of such a plant was broached at a meeting in Little Rock, sponsored by the cooperative, of farmers of 35 counties last month.

Newman Elected President of AIChE For 1948 Term

ALBERT B. NEWMAN, professor of chemical engineering at the College of the City of New York, was elected

A. B. Newman

F. J. Curtis

president of the American Institute of Chemical Engineers at the fortieth meeting of the Institute, held in Detroit on November 9-13. Francis J.

penn drake

paraffinic straight-chain hydrocarbons

ideal for the

manufacture of alkyl-aryl condensation products

To meet the needs of firms manufacturing Alkyl-Aryl Condensation Products, the Pennsylvania Refining Company has available a series of closely fractionated products derived from Pennsylvania Grade Crude Oil. Because of their high paraffinicity, these Penn-Drake Products are ideally suited for controlled chlorination, and a subsequent Friedel-Crafts reaction. Where a high degree of purity and uniformity are required, further treatment to remove all aromatics is given, resulting in highest quality saturated hydrocarbons.

It will pay those already in this field, and those who contemplate entering it, to investigate the advantages of these Penn-Drake Products.

penn drake petroleum products

Refineries: Karns City and Titusville, Penna.

Branches: Cleveland, Ohio; Edgewater, N. J.

Sales Offices In all Principal Cities

PENNSYLVANIA REFINING CO.

BUTLER, PENNA.

Makers of: White Oils (U.S.P. and Technical); Petrolatums (all grades and colors); INSECTI-SOL (deodorized insecticide base); Deodorized and other Naphthas; Petroleum Sulfonates; Waxes; Industrial and Motor Lubricants and Greases; Fuel Oils, and other petroleum products.

To get it faster look in

SWEET'S FILE

One hundred and ninety-five manufacturers' catalogs—1,520 catalog pages—instantly accessible in the 1948 Sweet's File for the Process Industries. There, right in your office, you will find up-to-date, useful and comprehensive information on forms, characteristics, performance and use of a wide range of materials, equipments and services.

Manufacturers' catalogs in Sweet's File are indexed by company name, by product and by trade name, so that you can find the information you want instantly—whenever you need it • • • • SAVE TIME—SAVE TROUBLE LOOK IT UP IN SWEET'S

Sweet's is always working to build a bigger and better file for manufacturers' catalogs so that buyers and sellers can get together faster and at lower cost. If you would like other manufacturers to include catalogs on their products in your Sweet's File, please send us their names.

If Sweet's File for the Process Industries is not available in your office, please address request for application to:

Sweet's Catalog Service
Distribution Dept.
119 West 40 St., New York 18, N. Y.

Free

to qualified organizations and individuals

S

Among plants visited by members of the AIChE at the annual meeting held in Detroit this month, was this phosphate division plant of Monsanto Chemical Co. at Trenton, Mich. The plant produces phosphoric acid and sodium phosphates

Curtis, vice president of the Monsanto Chemical Co., was elected vice president of the Institute for the 1948 term. Stephen L. Tyler and Carl R. DeLong were reelected secretary and treasurer respectively. Other highlights of the meeting included trips to 16 plants in the area and presentation of 33 technical papers. Symposiums were held on Fischer-Tropsch synthesis, ion exchange, low temperature processes, materials of construction, and chemicals and processed foods from agricultural products.

HeatTransmission Will Be Topic of Symposium

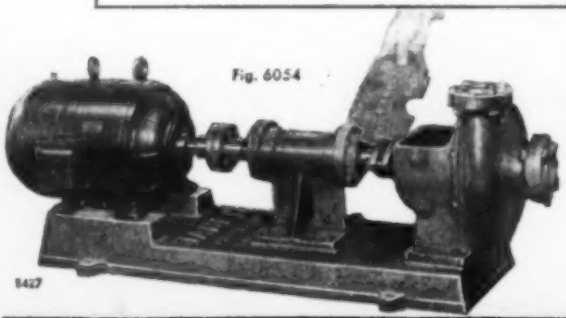
DEVELOPMENTS in the field of heat transmission will be the topic for the fourteenth annual chemical engineering symposium of the American Chemical Society which will be held in Chicago, December 29-30. Dr. Lincoln T.

NO AIR LEAKAGE THRU STUFFING BOX INTO VACUUM

Taber Single Suction Centrifugal Pumps are as adaptable as they are efficient.

For handling chemical solutions, they are equipped with a drip chamber and cover. When in vacuum service on evaporators, the water-filled drip chamber prevents air from entering thru the packing. This water-sealing of the stuffing box is absolutely dependable.

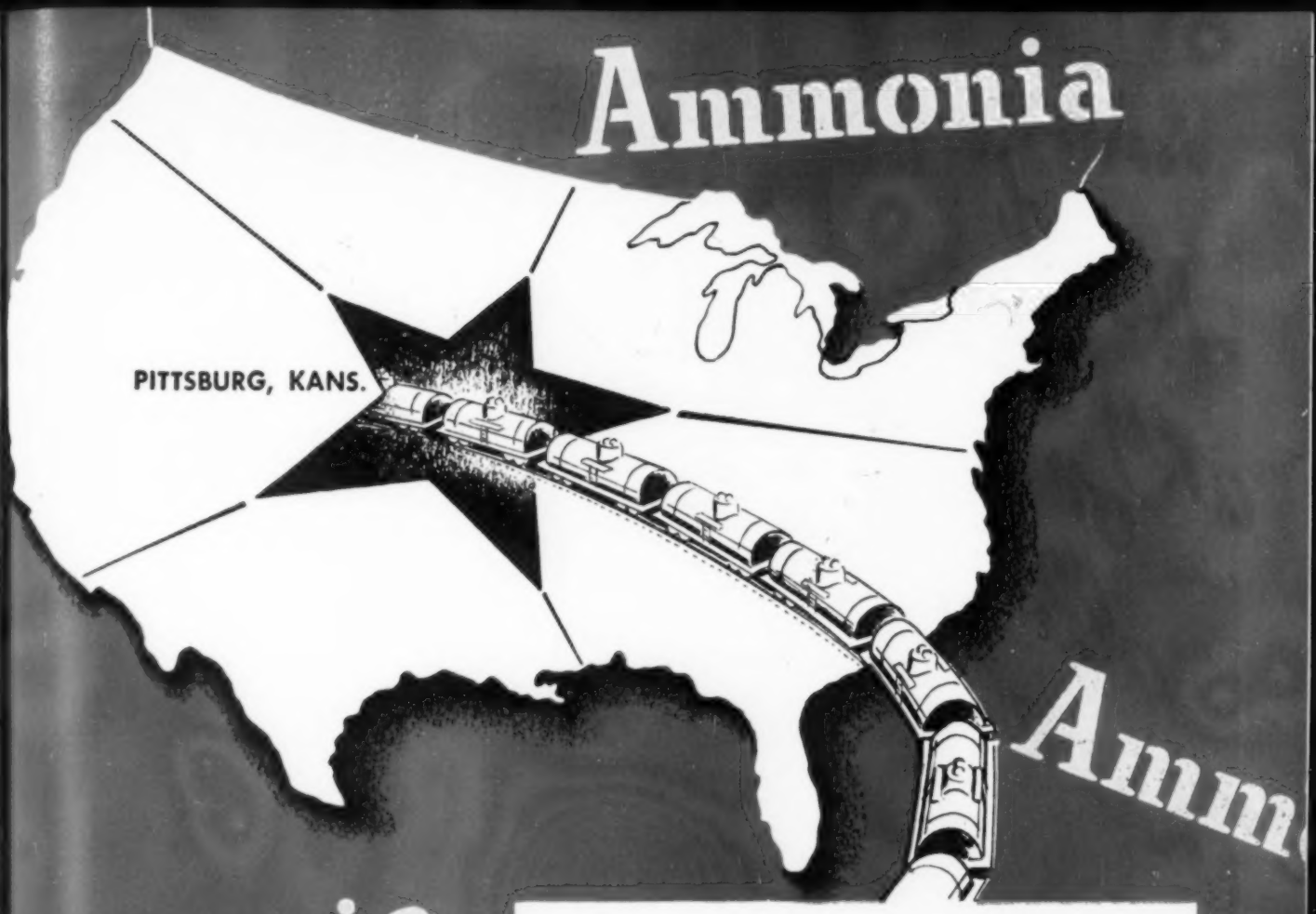
FOR COMPLETE INFORMATION, PLEASE WRITE ON YOUR LETTERHEAD FOR TABER
SPECIAL BULLETIN CL-339



TABER PUMP COMPANY
ESTABLISHED 1859
294 ELM STREET
BUFFALO 3, N. Y.

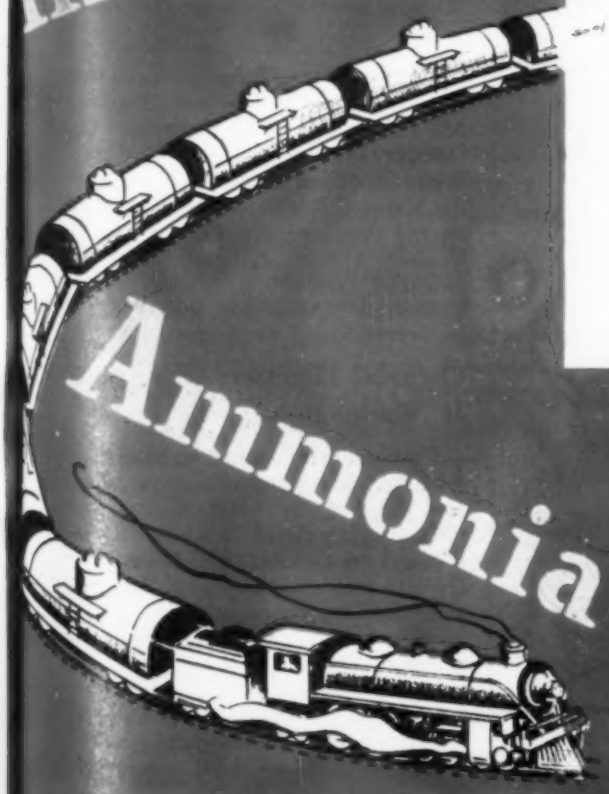
TABER PUMPS for Higher Practical Performance

Ammonia



Amm

Ammonia



Ammonia

DAYS CLOSER TO YOU...

ANHYDROUS AMMONIA:
Commercial grade: 99.5% NH_3; maximum moisture content, .05%. Typical Analysis: 99.95% NH_3; .03% moisture; 2-3 ppm oil.

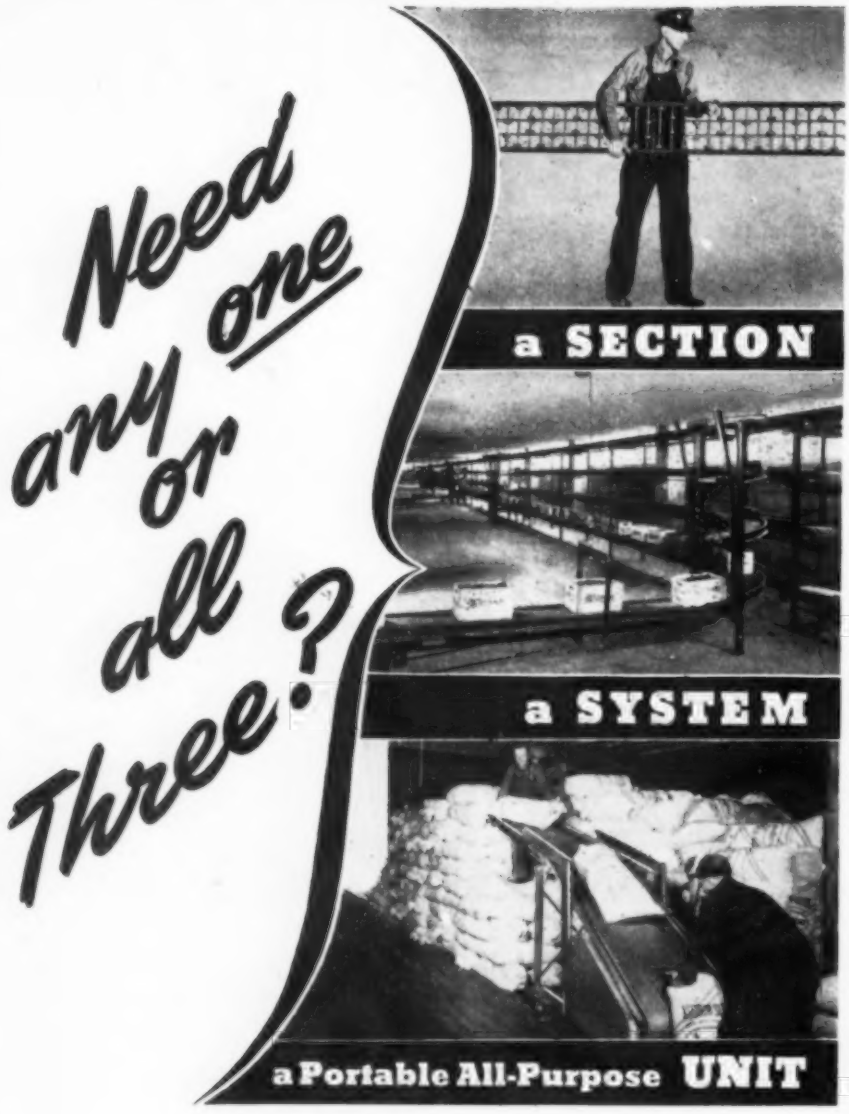
AQUA AMMONIA:
26° Baume grade, 29.4% NH_3 content. Color: water white. No H_2S or pyridine content.

For orderly, "as planned", deliveries, it pays to schedule your orders from Spencer's centrally located Pittsburg, Kansas, works, which is hundreds of miles and days closer to you. Phone or wire us today.

SPENCER

SPENCER CHEMICAL COMPANY
Executive and Sales Offices, Dwight Bldg., Kansas City 6, Mo.
Works, Pittsburg, Kansas

NUFACTURERS OF CHEMICALS FOR INDUSTRY AND AGRICULTURE



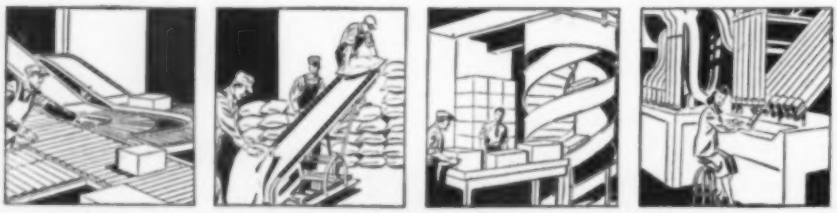
THE range and versatility of Standard Conveyor equipment is the result of nearly 40 years of close contact with conveying problems — large and small installations.

If you need just a light, portable section of conveyor to speed handling in warehouse or on shipping platform — complete, continuous flow system linking manufacturing or packaging operations — or a portable unit to speed handling in storage and shipping areas — Standard Conveyor Company can supply you with any one or all three.

Write for "Conveyors by Standard" Bulletin No. CM-117 — a valuable conveyor reference book that will be useful to you.

STANDARD CONVEYOR CO.
General Offices: North St. Paul 9, Minn.
Sales and Service in Principal Cities

Standard
GRAVITY & POWER
CONVEYORS

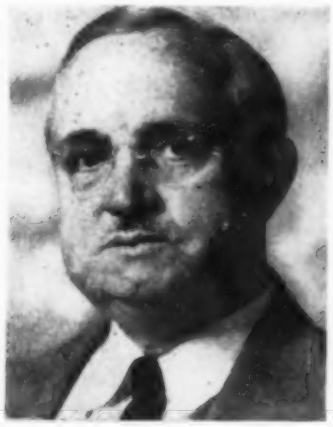


ROLLER · BELT · SLAT · PUSHBAR CONVEYORS • PORTABLE CONVEYORS AND PILERS • SPIRAL CHUTES • PNEUMATIC TUBE SYSTEMS

Work of Metal and Thermit Corp., Rahway, N. J., is chairman of the symposium committee. The technical program is under the direction of a subcommittee headed by Prof. Thomas Drew of Columbia University. Prof. Robert Kintner of the Illinois Institute of Technology is chairman of the Chicago committee in charge of local arrangements.

Electrochemical Society Forms New Division

THE Electrochemical Society held its semi-annual meeting in Boston, October 16-18 with over 400 members and guests. Technical sessions on (1) the per salts, (2) high temperature products, (3) new primary cells, (4) storage batteries, (5) electro-organic syntheses, and (6) electrodeposition were held.



G. W. Vinal

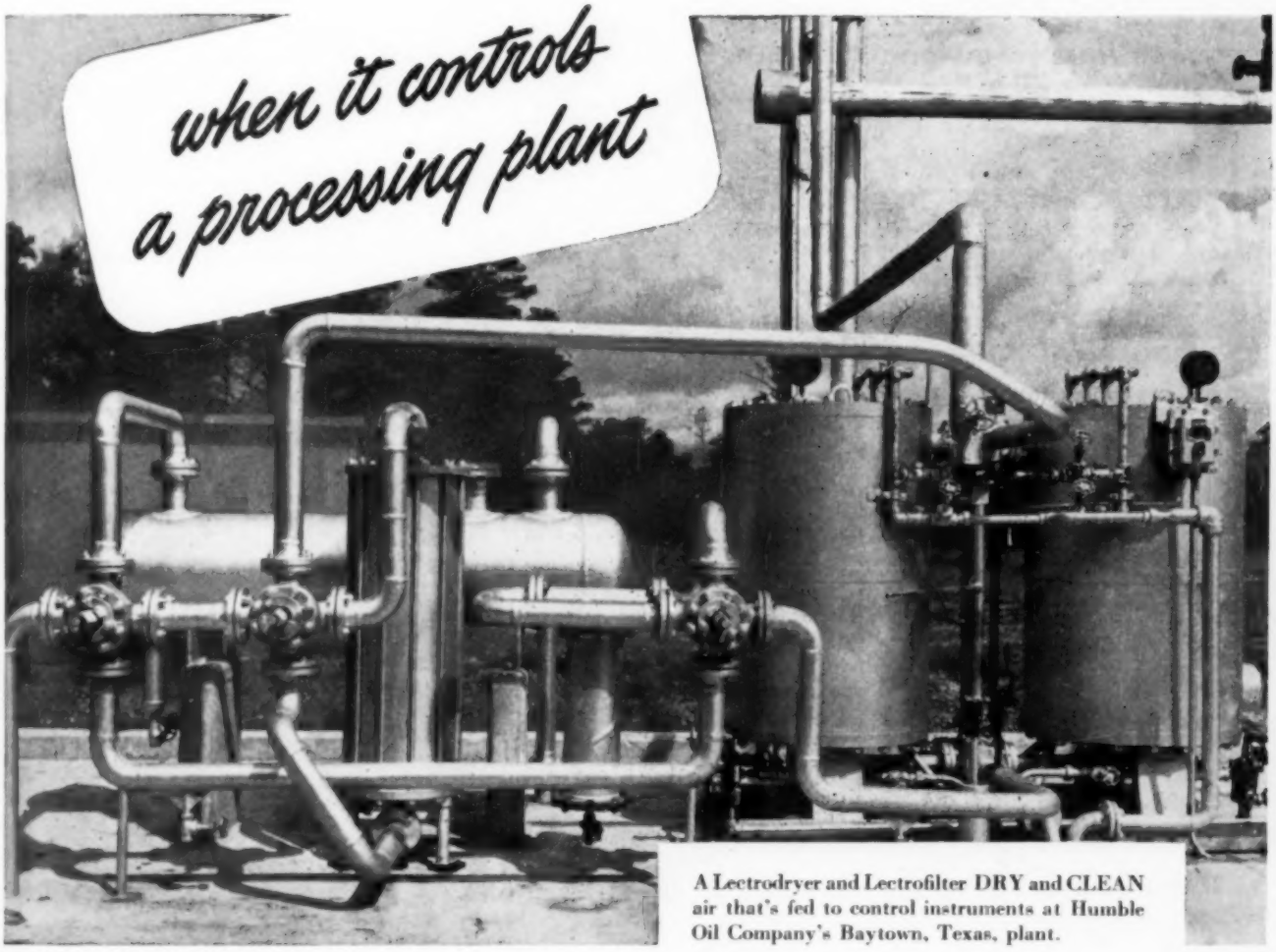
To its eight established divisions the Society has added a Battery Division. At the organization meeting on October 17, Dr. George W. Vinal, chief of the Electrochemical Section of the National Bureau of Standards, was elected chairman, Dr. C. C. Rose of Willard Storage Battery Co., vice chairman, and U. B. Thomas, Bell Telephone Laboratories, secretary.

Chemical Engineers Organize In Washington, D. C.

CHEMICAL ENGINEERS of the Capital City held an enthusiastic organization meeting to found an informal "Washington Group of Chemical Engineers" on October 2. This reestablishes a prewar activity in the profession on a loosely organized basis, including both members and interested nonmembers of AIChE. Later the group may become eligible for affiliation with the institute.

Officers elected by the new group to serve the 1947-48 fiscal year were:

Air must be DRY and CLEAN



A Lectrodryer and Lectrofilter DRY and CLEAN air that's fed to control instruments at Humble Oil Company's Baytown, Texas, plant.

DRY and CLEAN! Those are "musts" for the air going to instruments controlling a processing plant. Otherwise, rust and mud will form in the air lines and clog tiny ports, stalling equipment, stopping the flow of materials, upsetting processes. Or moisture will freeze with the same disastrous results.

Hundreds of Lectrodryers and Lectrofilters are at work throughout dozens of industries on this very job—DRYing and CLEANing the air as it leaves the compressors. They catch the vaporous moisture which aftercooler, separator and filters let slip by, and remove the oil picked up in the compressor.

If you're using air-operated equipment of any kind, make certain the air is DRY and CLEAN. Even a husky air hammer lasts longer when there's no moisture to corrode its valves and cylinders. For recommendations on Lectrodryers to handle your work, write Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Pa.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In Australia: Birlec, Limited, 51 Parramatta Road, Globe, Sidney.

LECTRODRYERS DRY
WITH ACTIVATED ALUMINAS

LECTRODRYER
REGISTERED TRADEMARK U.S. PAT. OFF.

Today's high cost of filter fabrics

makes impregnation with

THORATEX
REG. U. S. PAT. OFF.

more valuable than ever!

LOOK AT THESE ADVANTAGES

- Resistant to corrosive action of caustic and alkaline solutions
- Mildew and rot resistant
- Frequently outlast untreated fabrics three to one
- Maintains filtering capacity
- Smooth surface
- Cakes come away easily
- Reduce gumming
- Fewer washings required
- More continuous press operation
- Less shrinkage on press
- Non-capillary
- Better filtration
- Soft, flexible—sews easily

FREE TRIAL

Send us, prepaid, a roll of your cloth for finishing. Try it under actual plant operation.

Information and Samples on request.

METAKLOTH COMPANY
LODI, NEW JERSEY

This new Calco Chemical Division, American Cyanamid Co., plant at Willow Island, W. Va., will be completed this year. It will produce folic acid, melamine and pigments. Turner Construction Co. is building the plant which consists of five manufacturing buildings, a power plant, and a steel frame warehouse.

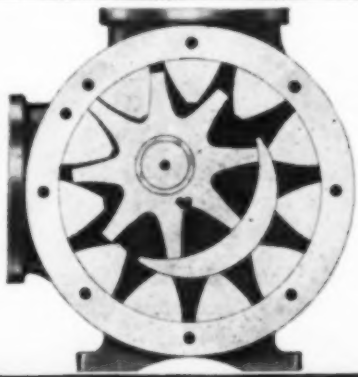
president, Russell S. McBride; vice president, John T. Cox, Jr.; secretary, R. D. Sheeline; and treasurer, D. O. Myatt.

At the first meeting a symposium program on the future of industrial alcohol was presented by four speakers, who discussed the following topics: Charles Gabriel, vice president, publicker Industries, "Alcohol from Molasses"; Leo M. Christensen, director, National Agrol Corp., "Chemurgic Alcohol"; Kenneth Burger, Chemical Development Division, Standard Oil Co. of New Jersey, "Alcohol from Ethylene"; and W. C. Schroeder, U. S. Bureau of Mines, "Alcohol from Fischer-Tropsch Operations."

Daugherty Refinery Adds To Sulphuric Output

DETAILS of an extensive new construction program that will include plant facilities for a recently-developed petroleum sulphonate have been an-

Here's a Worker!



VIKING ROTARY PUMPS

The pump that does the job well, day in and day out, is the one that's a worker. The Viking, with its "Gear Within a Gear—2 moving parts" principle, gives this type of service. Its rugged construction, without small intricate parts, springs, gadgets, etc., gives it the long, dependable life expected of a good pump.

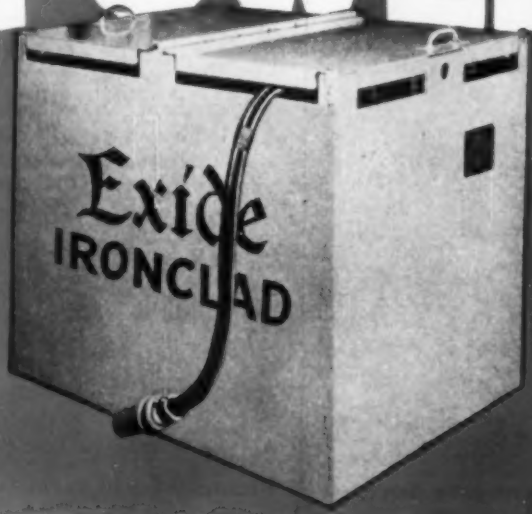
Viking rotary pumps are engineered for the job—to do the work assigned them. Ask for free folder 47SC today. Recommendations gladly given without obligation.

See Our Catalog In SWEETS

Viking PUMP COMPANY
Cedar Falls, Iowa

CLARK CLAMP LIFT TRUCK

DEPENDABLE POWER



EXIDE-IRONCLAD POWER AND BATTERY ELECTRIC TRUCKS

The efficient, cost-cutting team that speeds materials handling

You gain all along the line when your materials are handled by electric trucks and Exide-Ironclad Battery Power. This modern efficiency team keeps goods moving in greater volume, and saves time and money all day long.

Exide-Ironclad Batteries are preferred for electric truck service because of their great power and dependability . . . a result of special Exide-Ironclad construction, which is unlike that of any other battery.

One important Exide-Ironclad feature is the positive plate which consists of slotted tubes containing the active material. So tiny are these slots that, while permitting easy access of the electrolyte, they prevent the active material from readily washing away. The results are high power ability, longer life, greater economy and safety.

Write us for a FREE copy of Exide-Ironclad Topics which contains "Case Studies" of material handling problems. It tells how to cut handling costs up to 50% . . . covers latest developments in handling materials from receiving to shipping.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

CLARK CLAMP LIFT TRUCK

SAVE up to 50% on MILL COSTS with

MOREHOUSE HY-R-SPEED MILLS

MODEL SR-1400 (18" x 5") for processing non-corrosive materials

MODEL SS-20 (20" x 5") (Stainless Steel) for corrosive materials

Multiply production—Improve quality—Save space

Now you can have processing equipment that is amazingly compact, versatile and efficient at half the cost of old style mills. Occupying only a fraction of the space required by ordinary units, these new Morehouse models produce several times as much — better and more efficiently. They are designed for use on a wide range of materials, both wet and dry. Adjustment is quick and easy, either for individual materials or methods of processing including—

GRINDING, DISINTEGRATING, DISPERSING, MIXING, HOMOGENIZING, EMULSIFYING

The Morehouse high speed principle makes these revolutionary mills possible. Advanced engineering design and nearly half a century of experience in manufacturing quality products contribute to smooth, economical, dependable operation. Save money, save valuable space and improve both volume and quality with Morehouse HY-R-SPEED MILLS.

Write for complete details.

PAINTS · FOODS · PHARMACEUTICALS INKS · CHEMICALS · PLASTICS

MOREHOUSE INDUSTRIES
3156 San Fernando Rd., Los Angeles 31, Calif.
Since 1898

nounced by Daugherty Refinery, a division of L. Sonneborn Sons, Inc., at Petrolia, Pa. Among the other new facilities which will be in operation in early November is a 50-ton sulphuric acid plant. This plant will increase the refinery's production of sulphuric acid to 100 tons per day, with the output devoted exclusively to processing petroleum specialties at the refinery.

Monsanto Building New Formaldehyde Unit

ADDITIONAL formaldehyde capacity, which will ease the tight supply situation in that material, will be available when Monsanto completes its new unit in the second quarter of 1948 at Springfield, Mass. The new plant, added to a phenol plant at East St. Louis, Ill., and the melamine plant at Everett, Mass., will make Monsanto independent of outside basic chemical raw materials for its melamine and phenolic resins.

Flaxseed Processing Plant Planned for Texas

A FLAXSEED processing plant is planned for construction at Kenedy, Tex., by the Archer-Daniels-Midland Co. The $1 million plant will be started immediately. It will include facilities for cleaning flaxseed, a linseed oil refining unit and a byproduct farm feed manufacturing unit.

Victor Erecting Plant At Morrisville

PHOSPHORUS compounds for use in the chemical, pharmaceutical, and food industries will be produced at the $1.5 million Victor Chemical Works plant now under construction at Morrisville, Pa. The new unit will supplement output at Victor's plants at Nashville, Tenn., and Chicago Heights, Ill.

Industry Briefs

A generic name for protein-base synthetic fibers such as nylon and casein types, has been recommended by Committee D-13 of the ASTM. The name is "azlon." Although this name has not yet gained widespread use, it is intended to be comparable to the word "rayon" which is used to designate all cellulose-base synthetic fibers.

A service school in petroleum chemicals, on the post-graduate level, has been established as the Du Pont Co.'s first step in a greatly enlarged research, sales and technical program in that field.

Truck Bodies on Casters Speed-Up Production!

Easily rolled to any part of your plant, these 3 cu. yd. tilt type bodies speed production and cut handling costs on raw materials, finished products or waste. Any number of these or other type bodies can be handled, from your loading platform, by one Dempster-Dumpster truck hoisting unit. As shown here, loaded bodies are rolled to loading points, picked up, hauled, dumped and returned . . . a continuous cycle of operation. Standard or special bodies in 1½ to 10 cu. yd. capacity are built to handle any type of material. Cost of installing is surprisingly low. Write for catalog 247 today.

DEMPSTER DUMPSTER

DEMPSTER BROTHERS, INC.
1117 Springdale, Knoxville 17, Tenn.

Auto-Lite Indicating Thermometer F-1, illustrated, can be supplied with adjustable, electrical alarm contacts at small additional cost. Hooked up with a bell transformer circuit, it gives a warning bell or light signal when temperature rises above desired level.

. . . Use this Precision-made Auto-Lite Thermometer in Operations where Temperature is Important!

"Taking temperature" is easy when you have Auto-Lite Indicating Thermometers. All you have to do is to mount the dial head where readings can be taken most conveniently. The capillary tubing permits temperature to be observed at some distance from the temperature source, even in another room if necessary. In power plants, in the processing of chemicals and foods, and in all other operations where uniform temperature is important, Auto-Lite Indicating Thermometers help to save money, time and materials. Install them for greater efficiency.

AUTO-LITE RECORDING THERMOMETERS

Model "500" is designed for use where accurate charting of temperature is needed. In service, it complements the F-1 Indicating Thermometer for food lockers, quick freezing and other low temperature applications. Model "500" Recording Thermometers have either 24 hour or 7 day mechanical clock movement. Highly visible, 6" chart, with exceptional range coverage. Capillary tubing permits remote reading. Further details on request.

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION • TOLEDO 1, OHIO
New York Office: Chrysler Building • Chicago Office: 600 S. Michigan Blvd.

AUTO-LITE
INDICATING & RECORDING THERMOMETERS

TUNE IN THE AUTO-LITE RADIO SHOW STARRING DICK HAYMES—THURSDAYS, 9:00 P.M.—E. T. ON CBS

What is your Wax Problem ?

GLOSS? HARDNESS?

Investigate Petrolite Crown Quality Waxes 700 and 1035. Their extreme hardness and glossiness are effective in any formulation requiring gloss.

	MELTING POINT °F MIN.	PENETRATION 100 GM.	COLOR N.P.A.
Crown 700	190/195	5 Max.	2 to 2½
Crown 1035	195/200	2 Max.	2 to 5½

EMULSIFICATION?

Petrolite Crown Waxes 23 and 36 are especially applicable in no-rub polish formulations. Used to extend more costly vegetable waxes, they are extremely economical, without detriment to the resulting product.

	ACID NUMBER	SAPONIFICATION NUMBER	COLOR N.P.A.
Crown 23	20 - 25	55 - 65	4½ - 6
Crown 36	30 - 35	85 - 95	5½ - 8

Emphasis here of these features of Petrolite Crown Quality Waxes in no way tells the entire story. The Petrolite line includes a variety of waxes with widely differing characteristics and many economical advantages. Write today for the Petrolite Wax booklet and samples.

Petrolite

PETROLITE WAX

PETROLITE CORPORATION, LTD.
Wax Division
29 Broadway, New York 6, New York
Refinery, Box 390, Kilgore, Texas

READERS' VIEWS AND COMMENTS

Periodicals

To the Editor:

Sir: — The Committee on Foreign Compendia of the American Chemical Society has been advised that the groups preparing new volumes of Beilstein's Handbuch and Gmelin's handbuch are handicapped by the lack of the *Chemical Engineering* (formerly Chemical and Metallurgical Engineering), *46* (1939) to date.

Among the many subscribers to the *Chemical Engineering* there must be individuals who would part with the desired numbers of their file, perhaps now past its prime usefulness to them and additionally available to them through their company or institutional libraries, rather than see the preparation of these great and essential handbooks suffer from lack of sources.

Will anyone wishing to donate one or more volumes of *Chemical Engineering* (formerly Chemical and Metallurgical Engineering), please get in touch with the undersigned at the Chemistry Department, Purdue University, and our committee will see that they reach the right place.

H. B Hass

Lafayette, Ind.

Books and Periodicals

To the Editor:

Sir:—Finland has an excellent and keenly scientific minded Technical Institute, Teknillinen Korkeakoulu. During the war its library was destroyed.

On my recent trip to Finland for the American Friends Service Committee, I discussed the situation with Dr. Martti Levon, director of the Institute. He said he would welcome gifts of scientific and technical books and periodicals to take the place of those which were destroyed. In the remarkable efforts for recovery that the Finns are making, the lack of technical library facilities is a very serious handicap. It would be a practical act of friendship to a nation that holds America in high regard if Americans should contribute good technical books and periodicals to this library.

Any such gifts should be marked for the Institute of Technology, Helsinki, and sent to the Legation of Finland, 2144 Wyoming Ave., N.E., Washington, D.C. Dr. K. T. Jutila, the Finnish Minister, will arrange for their being sent to Finland.

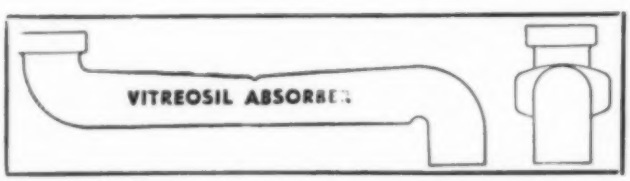
Arthur E. Morgan

Yellow Springs, Ohio

VITREOSIL

(VITREOUS SILICA)

Generating, Cooling and Absorbing Equipment For Hydrochloric Acid



Synthetic, Salt-Sulphuric or By-Product

Efficient, Economical, Produces Purest Acid

Units handle from 6 to 250 pounds of gas per hour

Send for Bulletin No. 4

VITREOSIL — SILICA

The THERMAL SYNDICATE Ltd.
12 East 46th Street New York 17, N. Y.

NEWS FROM ABROAD

Special Correspondence

LARGER SUPPLIES OF RAW MATERIALS BRING GRADUAL RISE IN BRITISH CHEMICAL OUTPUTS

More persons are now at work in Britain's chemical industry than ever before, and chemical firms are securing some of the labor released from less essential trades. There is thus a constant, if slow, increase in chemical employment, which is matched by a gradual advance in chemical production, but home demands and export calls are still far ahead of the supply in most important chemicals. Thanks to the mild weather, the feared fuel shortages have so far failed to materialize.

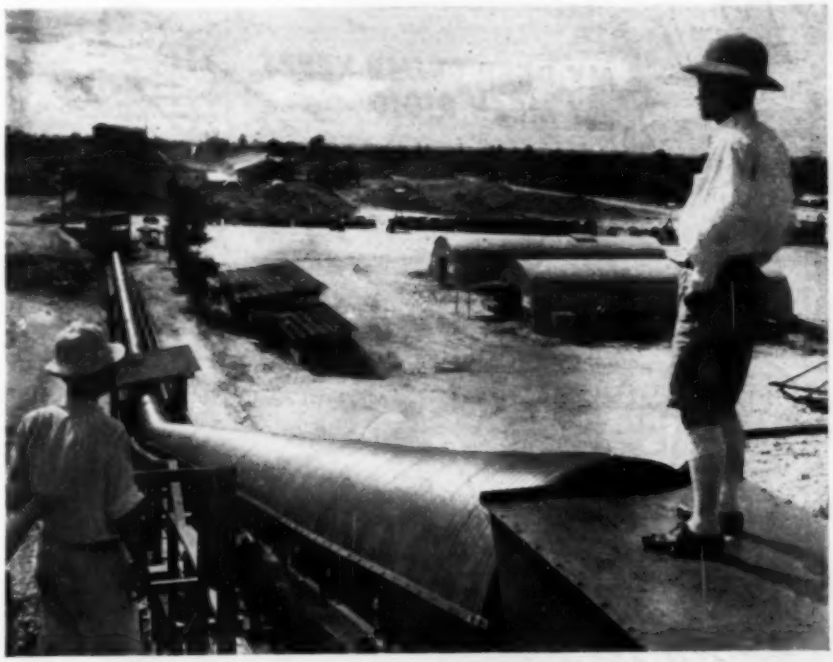
Both solid and liquid fuel and electric power are at present available in adequate amounts, and while coal production is unlikely to reach the government's target of 200,000,000 long tons for the whole of 1947, the present output rate would in fact be sufficient to maintain a slightly higher level of industrial activity than the present one. Coal stocks are still being built up in consuming areas. Stockpiles are now well ahead of the target figures as far as coal is concerned, while the supply of fuel oil shows no signs yet of any untoward difficulties created by the rapid expansion of consumption under the government's coal-to-oil conversion scheme.

Chemical raw materials continue to reach Britain in satisfactory quantities. The foreign exchange difficulties and the restrictions imposed on exports in various overseas countries have not interfered with the smooth flow of chemical imports. Some such articles as carbon black which were in short supply are now coming in at an adequate rate, while imports of potash salts are on such a large scale that all reasonable agricultural needs should be met easily. Chemical fertilizers and materials for their manufacture feature prominently in Britain's import trade, and bigger supplies from continental Europe have helped to overcome threatening shortage. The agricultural development program calls, of course, for larger supplies of fertilizers.

Quite generally, it has been noted that more chemical manufactures, as distinct from crude raw materials, are now reaching Britain from western Europe. France, Switzerland, Belgium and Holland have been able to make considerable headway in chemical export trade this year, and part of their larger shipments has gone to the English market. Moreover, the authorities seem intent upon promoting imports from continental Europe of sulphur, pyrites, potash, bauxite, carbide and other import commodities for which Britain relies on foreign supplies, in order to reduce currency holdings and open the road for further British exports to these countries. The development is watched with considerable interest by British chemicals makers because of the light it throws on relative costs in Britain and continental countries.

The increase in coal and rail transport charges has been followed by price advances for coke, gas and coal-tar products, for chemical fertilizers, glycerine, stearine and soap, for rayon and a number of fine chemicals and drugs, and further rises are forecast. It is to be noted that the advances are generally only just sufficient to meet additional costs. Manufacturers know the importance of the price factor too well to take advantage of existing shortages, and the official price control system is an effective means of checking increases which are not justified. Nevertheless prices continue to rise. This may be of little moment in the home market as chemicals do not weigh heavily among the production costs of chemical-consuming industries, but in the export market further price advances may seriously impair Britain's competitive position.

If British chemical manufacturers



With American permission, the Japanese have returned to mining phosphate rock on the island of Anguar, in the Palau group. Monthly quota for production is 7,500 tons for the rest of this year which will be doubled next year. Above is a view of conveyor belts which carry dried phosphate from the drying shed to the docks

TAKE IT FROM CRIMPY
THE BUFFALO WIRE CLOTH MAN
"There's Nothing Like 'BUFFALO' PLAIN STEEL WIRE CLOTH for All Around Strength and Low Cost."
MY WIRE IS FINEST GRADE STEEL
. . . each size is carefully selected from our choice of the nation's best mills. That accounts for my extraordinary weaving and crimping qualities.
MY MESH IS ALWAYS ON THE BUTTON
. . . never misses . . . always accurate . . . and I have just about the largest variety of weaves in the business . . . from round or flat wire.
MY DEEP CRIMP KEEPS MY MESH RIGID
. . . holds it firmly in place . . . gives me long life. I'm crimped many ways for all kinds of service.
I'M WOVEN IN MANY SIZES
. . . of meshes and wires for every industrial need.
Check your files for our INDUSTRIAL WIRE CLOTH CATALOG. If you haven't a copy, you can get one by dropping us a line.
Buffalo WIRE WORKS CO., INC.
Manufacturer of All Kinds of Wire Cloth Since 1869
482 TERRACE
BUFFALO 2, N. Y.

reach the export targets set them by the government and if North American and European exporters maintain their business abroad at the highest levels reached this year, chemical supplies for the world market will next year surpass the prewar level even though Germany, before the war the biggest chemical exporter in the world, is still out of the race.

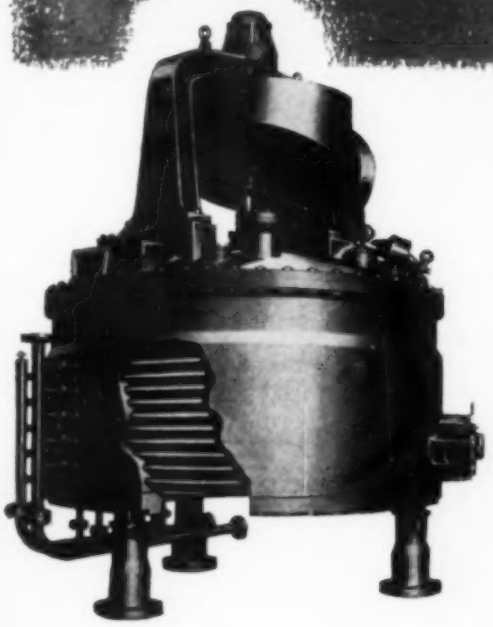
Allocated Materials

The government has made it clear that supplies of raw materials in a critical position will in future be allocated in strict proportion to export achievements. While this announcement chiefly applies to steel for mechanical and engineering trades, it may before long be applied to certain commodities needed in the chemical industry. The government's export targets were split according to individual industries, but nothing has yet been said about the distribution of export targets among individual firms. This would normally be a matter of arrangement between the private interests concerned, but if such arrangements cannot be made or individual firms ignore export opportunities, the authorities may well make use of their wide powers for directing labor, fuel and raw materials to other factories. This threat overhangs many of the smaller firms which do not have the necessary organization and marketing facilities for export promotion and now discover that complete reliance on the home market may be looked upon with displeasure by the authorities.

Fears that the intensification of the export drive would deprive British chemical manufacturers of the opportunity of replacing worn out machinery and modernizing their equipment have been to some extent allayed by an official statement that in view of the early and significant contribution which chemical manufacturers can make to the export drive, chemical plant would not be given export priority.

While British chemicals makers are not given the priority treatment of the domestic coal mining industry, their needs with regard to plant replacement and modernization are thus at last acknowledged. During the past two years many firms have made do with wartime equipment adapted to their particular requirements in order to escape long delivery delays for new machinery, but this method of improvization has great drawbacks. Hopes for an alleviation of the position by imports of chemical apparatus and equipment on reparations account have not been fulfilled and are not

HOW BETHLEHEM THERMOCOILS *will help the busier than ever* PROCESS INDUSTRIES



Yes Sir, the processing inaustries are demanding more precision equipment for 1947-1948 and the years immediately ahead than ever before.

Processing the new synthetic resins, varnishes, dyestuffs and other countless organics and pharmaceuticals have indicated the need for this equipment — particularly BETHLEHEM Process equipment.

A special advantage that we provide *YOU* is the service of our Chemical Engineering Department. Your specific processing problems are thoroughly analyzed and problems involving more than ordinary temperatures, thermal transfer, and corrosion resistance given every attention. Included in this service is the availability of the Engineering Colleges of Lehigh University, close to our plant—for the testing of materials, pilot plant work and chemical, metallurgical, mechanical, mining and electrical engineering consultation.

OPERATIONAL FEATURES OF BETHLEHEM THERMOCOIL EQUIPMENT

1 Built with a series of steel tubes cast into and integral with the walls of the vessel.

2 This homogeneous construction of tubing and wall areas insures highly efficient thermal transfer

3 Thermocoil Equipment is ordinarily heated by steam —but other fluid heating mediums may be used when high temperatures, beyond those available with steam pressures, are required.

4 There are many advantages in using Thermocoil Equipment in the higher temperature ranges:

a. Increased thermal efficiency including an elimination of hot spots.

b. Ease of temperature control.

c. Saving of fuel and maintenance costs.

d. Bethlehem eliminates the fire hazard found in ordinary direct fired equipment. The source of heat can be removed from the reaction vessel so that a fire wall can be built between heater and vessel.

5 Cooling operation with Thermocoil Equipment are unusually efficient. The coolant, circulating through the tubes at high velocity causes a speed of thermal transfer impossible in jacketed vessels.

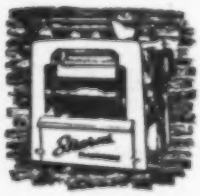
BETHLEHEM THERMOCOIL Equipment is specified for better heating—better cooling—greater uniformity of YOUR PRODUCTS. Write us today about your specific processing problems—we believe we can help you.

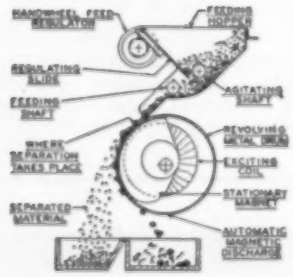
BETHLEHEM

BETHLEHEM FOUNDRY & MACHINE COMPANY, BETHLEHEM, PA.

MAGNETIC
Separators for
RECLAIMING
METALS

Scrap metal values go up when you use this improved Stearns Type "L" Magnetic Separator for reclaiming your brass, aluminum, babbitt and other secondary metals from turnings, borings, chips and metal refuse. Automatic, efficient, economical, a definitely profitable investment.





Stearns MAGNETIC MFG. CO.
629 S. 28th St.
Milwaukee 4, Wis.

SEPARATORS • CLUTCHES • MAGNETS

expected to alter the situation materially.

While chemical plant makers admit the home industry's claim to first call on available supplies as justified, they naturally wish to take advantage of the great opportunities open to them abroad, especially in the Dominions. The government, while welcoming exports of chemical plant on principle, seems lately to have veered round to the point of view of the British chemical industry, partly because of the latter's important role in the export trade and partly because of the shortage of steel which makes the worth of exports involving large amounts of iron and steel somewhat doubtful.

It has been suggested that the problem might be partially solved by exports of blueprints and instructions, thus obviating the need to draw on raw materials in short supply. It should certainly be possible to save steel for chemical equipment by concentrating on the more difficult parts, entrusting local firms overseas with the supply of others.

A delegation of the British Coke Research Association has gone to the United States to carry out an extensive investigation of the technical aspects of the American coke oven industry. This visit is believed to be connected with the extensive plans for the erection of new coke-oven plant now under consideration by the National Coal Board and the iron and steel industry. Some of the plants to be erected will stand comparison in size with any coke-oven plant in existence in the British Isles, and this construction program as a whole will be the largest ever projected in the country.

FRENCH CHEMICAL OUTPUTS EXPAND IN THE FACE OF FUEL AND RAW MATERIAL SHORTAGES

French chemical industry, in common with most French industries, stands to suffer from cuts in fuel and power and numerous imported raw materials forced by France's dollar shortage. French chemical production had been brought back as a whole to about 130 percent of the 1938 level by last summer, but this level seems unlikely to be maintained during the winter. Certain important products such as sulphuric acid, fatty bases, soaps, have continued to be held down, however, by lack of raw materials; while others such as glass, detergents, superphosphates, soda ash, rayon and plastics, are very substantially above prewar levels.

On August 26, France suspended all purchases except grains, fats and coal from the "dollar zone," which for the French includes the American hemisphere except Argentina and also most of the Middle East. The authorities subsequently modified this prohibition as far as certain chemical raw materials are concerned. In the first place, it did not operate against contracts already made. Petroleum refiners operating on American crude, for example, already had in stock or under contract sufficient crude to continue operations for periods ranging from the middle of November to the end of the year. Furthermore, the government tentatively agreed to allot refiners $12 million more to buy crude, the money being derived from the coal purchase fund. This, if actually allocated, should see all the refiners through to the end of the year, at which time it is hoped aid from the U. S. Congress will become available.

Other special arrangements for dollar imports in the present crisis include $400,000 allocated to purchase sulphur, and a continuation of the import program for Chilean nitrates (36,000 tons for $1.5 million). An arrangement is also being worked out to exchange 34,000 tons of potash against the same tonnage of ammonium nitrate from Canada, with a supplemental payment to the Canadians of $500,000.

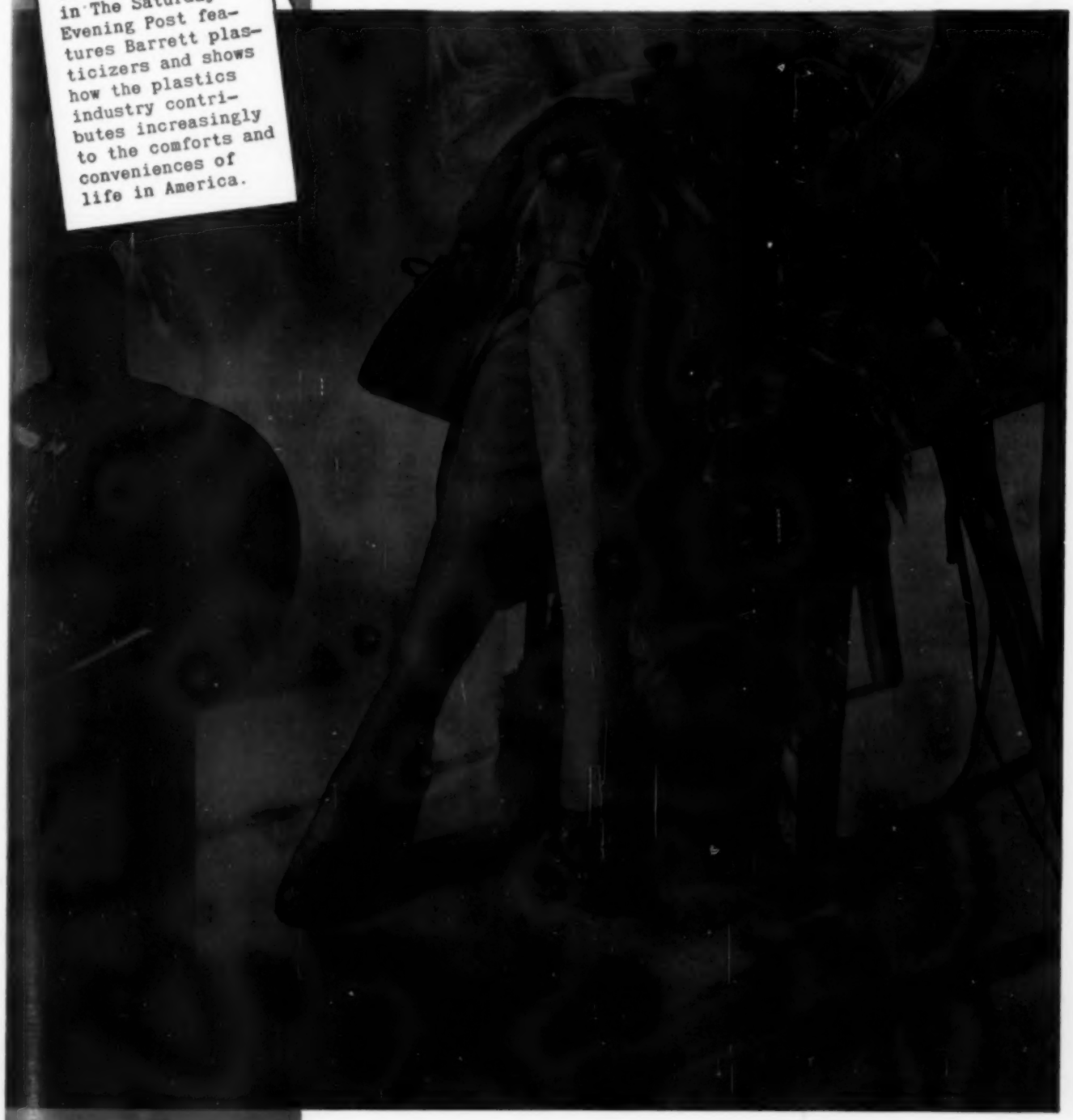
Industries depending on woodpulp have been hit by cancellation of allocations of 3,800 tons of pulp from the U. S. and Canada. It is hoped part of this deficit may be met by quick return into operation of a German pulp plant at Rheindurkheim in the Palatinate. The French government has just approved plans to start this plant again for production of 10,000 tons a year of pulp, using straw as a base. The Societe Francaise de Cellulose has also been considering construction of a plant for producing woodpulp for paper near Marseille, using the Arondo-Donax process; but this would obviously have little effect on the present situation.

Another blow to French chemical industries has been the requirement instituted September 24 that all factories work only four days a week in order to save coal. However, electrochemical plants are exempt from this requirement, and plants making such products as artificial fibers, petroleum products, sulphuric acid, glass, tanning extracts, pharmaceuticals, explosives and coal-tar products may apply for individual exemptions.

In the export field a new market

This advertisement in The Saturday Evening Post features Barrett plasticizers and shows how the plastics industry contributes increasingly to the comforts and conveniences of life in America.

PLASTICS are what you make 'em! There are plastics like leather, like rubber, like metal and like silk, that are better than nature's own materials for their specific purposes. Many of these plastics are made with basic coal-tar chemicals for which Barrett is a key source of supply.



Barrett

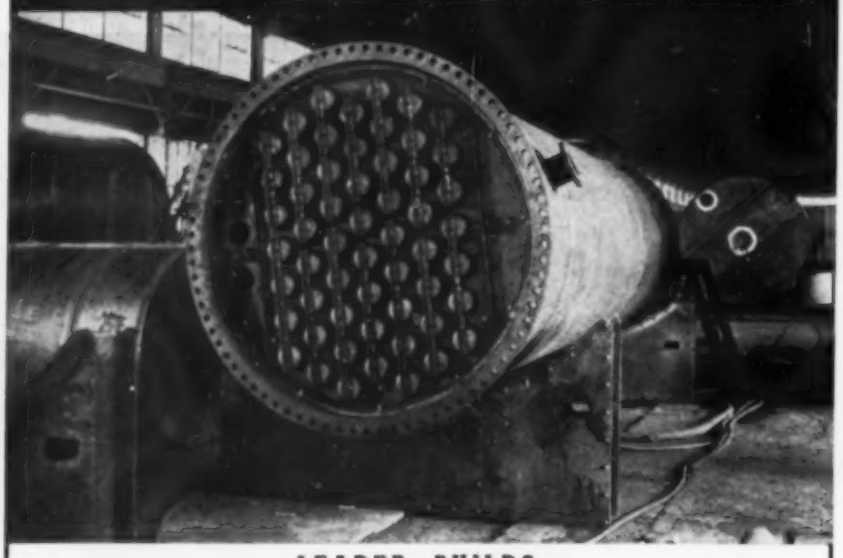
THE BARRETT DIVISION

AMERICA'S LEADING PRODUCERS of plastics rely heavily on Barrett for the basic coal-tar chemicals which go into their products. They know that the quality and uniformity of Barrett Chemicals are effectively safeguarded by the most rigid manufacturing controls. Today, Barrett stands ready to serve the great plastics industry with increasing numbers and quantities of chemicals and solvents.

DIBUTYL PHTHALATE DICYCLOHEXYL PHTHALATE PLASTICIZER-50B
PHENOLS CRESOLS CRESYLIC ACIDS PHTHALIC ANHYDRIDE
CUMAR* Paracoumarone-indene Resin

*Reg. U. S. Pat. Off.

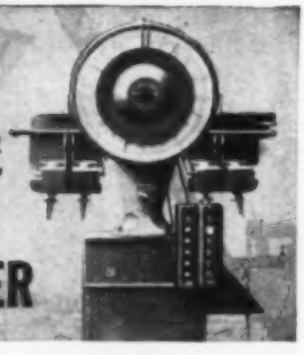
FRACTIONATING COLUMNS



LEADER BUILDS
TANKS — KETTLES — FRACTIONATING COLUMNS
HEAT EXCHANGERS and SPECIAL EQUIPMENT
OF
STEEL—STAINLESS STEEL—NICKEL—MONEL
INCONEL—COPPER—EVERDUR—HERCULOY
HASTELLOY — ALUMINUM and CLAD STEELS

LEADER IRON WORKS, INC.
2200 N. JASPER DECATUR, ILLINOIS

AT LAST...
A PRACTICAL
Automatic
WEIGH BATCHER



NOW CONVEYCO offers the finest development in automatic weigh batching — an Electronic Controlled Weigh Unit, which can be adapted to any weigh batching equipment. No complicated mechanisms. This Conveyco Unit is designed around standard electrical equipment, using a dial scale with *single indicator* and *one photo electric cell.*

Modernize your old outmoded Batchers, Ready Mix Plants or Asphalt Hot Plants with this new Conveyco Electronic Weight Control Unit. Write for information.

Investigate Conveyco Portable Batch Plants and Portable Bulk Cement Silos — also the Conveyco never-leak Cement Valve for Cement Hoppers and Bulk Cement Silos.

THE CONVEYOR CO.
ENGINEERS • MANUFACTURERS

which French firms may seize on is offered by Argentina. Following the Franco-Argentine trade treaty which Eva Peron signed on her visit to Paris last summer, and which opened a five year credit to France of 450,000,000 pesos, French exporters of pharmaceuticals and nearly all chemicals will get full benefit from the opening up of Argentine import regulations. France and Belgium are included in a small list of favored countries whose exporters need apply only for import permits from the Argentine national bank.

Growth of Plastics

Plastics have been enjoying a modcrate boom in France. The industry is held back not by lack of capacity or demand but chiefly by scarcity of raw materials including such products as plasticizers and woodpulp. Prewar output of plastics was 12,000 tons and this has probably risen to the neighborhood of 20,000 tons. Molding is generally by injection for thermoplastic products and by compression for thermo-hardening products, with little development of molding by transfer, by jet or by pouring.

Phenolic resins are an important branch of the industry, and the name Bakelite is well known in France. Impregnated textile or wood or paper products are widely used in bushings, bearings, and gears. Output of all phenol plastics is well over 50 percent above 1938. Output of amino-plastics has increased substantially, with impregnated panels being used in furniture and decoration. Chief bottleneck here is urea, all of which has been imported and of which supplies last year were only about 1,000 tons. Several synthetic urea plants are now under construction.

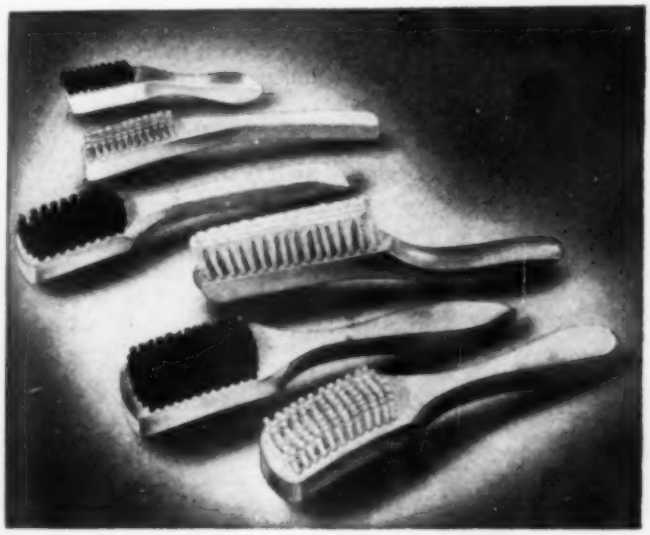
Cellulose acetate and celluloid are being turned out at one and a half to two times the prewar rate, and a considerable demand has developed also for polystyrols. Acrylic resins have developed much less extensively for use as glass in automobiles in France than in the U. S., but plexiglas is used to a certain extent for that purpose and for airplanes. Output of these resins has expanded for these and other uses and is now almost sufficient to satisfy present needs. Demand for vinyl resins has jumped tremendously, but production has risen much more slowly due to shortage of electric power needed for production of calcium carbide. Demand is now estimated as high as five times the available supply, which runs over 300 tons monthly.

Galalith, of which 3,000 tons was produced yearly before the war is now down to about a quarter of that level because of the shortage and high

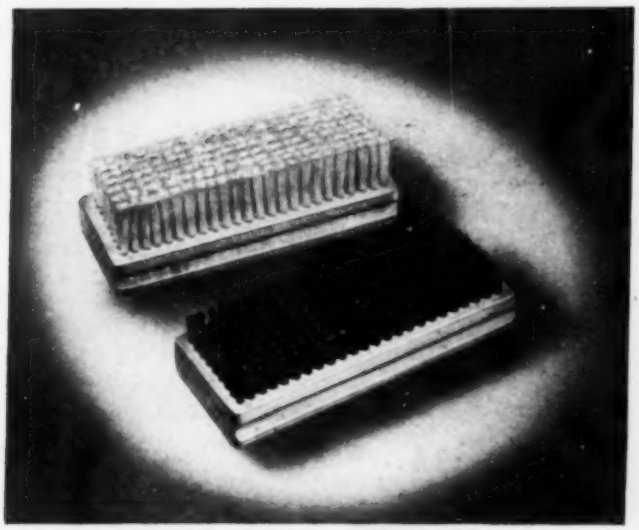
HOW CAN NYLON BRISTLES WORK FOR YOU?

Here are 3 ways brushes bristled with Du Pont NYLON are serving the chemical and allied industries

1. SYRUP TANK BRUSH, bristled with Du Pont nylon, stands up on the job far longer than similar brushes with other types of bristles. Nylon bristles are unaffected by cleaning agents, resist constant immersion, most chemicals and abrasion.



2. SPOTTING BRUSHES with Du Pont nylon bristles are used in the dry cleaning industry. They outlast brushes made with other types of bristles, save money in replacements.



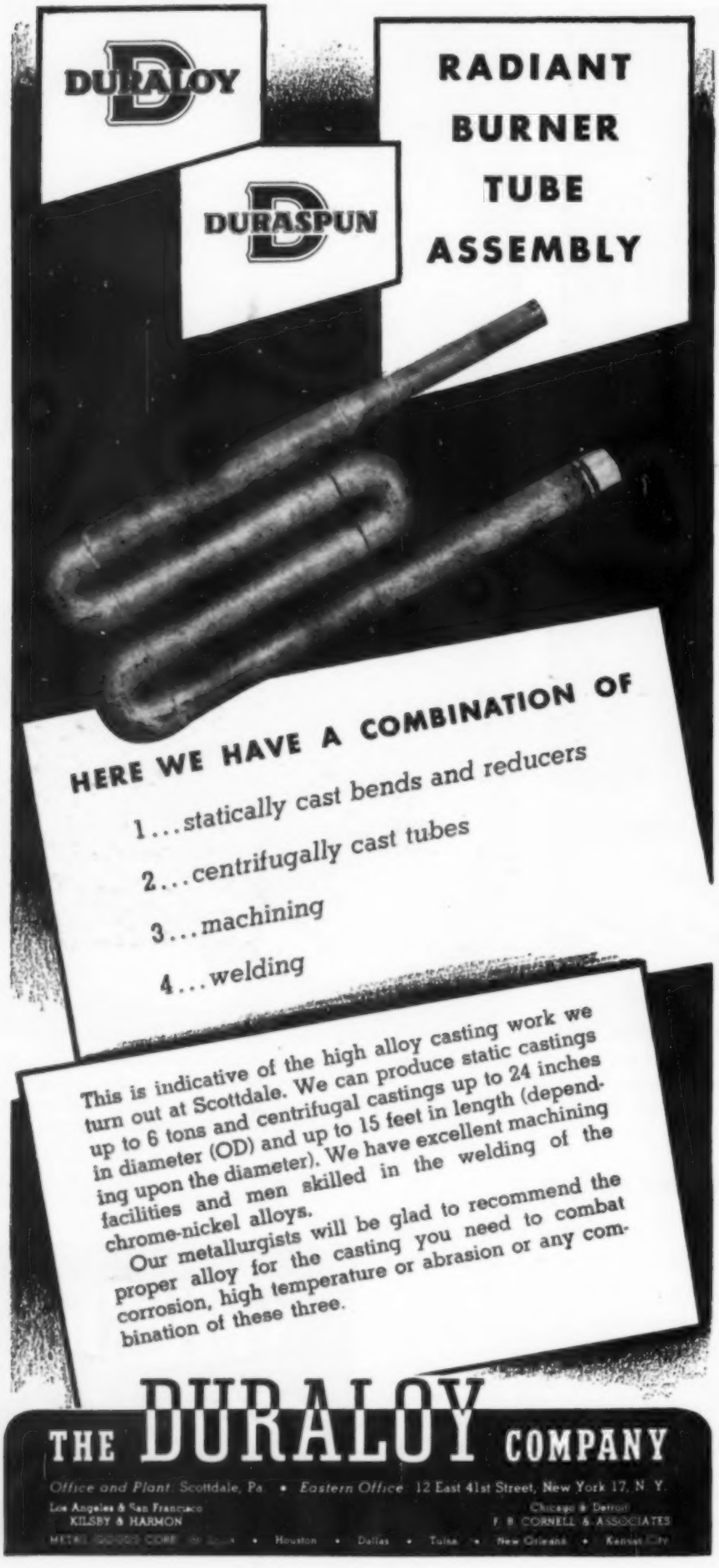
3. BENZINE BRUSHES bristled with nylon withstand hydrocarbon solvents, constant abrasion and flexing. Such brushes are made to meet specific requirements and can be had in various degrees of stiffness or softness, depending on the job.

LONGER, MORE EFFICIENT SERVICE

That's what you get in brushes made with Du Pont nylon bristles. And that's why more and more industries today look to nylon for the answer to their brush problems. Like the manufacturers who profit with the brushes shown above, you may find a nylon-bristled brush to serve you more efficiently. In some cases, nylon bristles outlast other types of bristles up to 12 to 1. Just write us describing your brushes, and we'll be glad to work with your regular brush manufacturer—or help you locate the firm that will make nylon-bristled brushes to meet your exact needs. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Room 1011, Arlington, N. J.

FREE BOOKLET—*"Industrial Brushes Made With Du Pont Nylon." Filled with helpful facts. Send for it!*

DU PONT
REG. U. S. PAT. OFF.
Plastics
BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY


DURALOY
DURASPUN
RADIANT
BURNER
TUBE
ASSEMBLY
HERE WE HAVE A COMBINATION OF
1...statically cast bends and reducers
2...centrifugally cast tubes
3...machining
4...welding
This is indicative of the high alloy casting work we turn out at Scottdale. We can produce static castings up to 6 tons and centrifugal castings up to 24 inches in diameter (OD) and up to 15 feet in length (depending upon the diameter). We have excellent machining facilities and men skilled in the welding of the chrome-nickel alloys.
Our metallurgists will be glad to recommend the proper alloy for the casting you need to combat corrosion, high temperature or abrasion or any combination of these three.
THE DURALOY COMPANY
Office and Plant: Scottdale, Pa. • Eastern Office: 12 East 41st Street, New York 17, N. Y.
Los Angeles & San Francisco
KILSBY & HARMON
Chicago & Detroit
F. B. CORNELL & ASSOCIATES
Houston • Dallas • Tulsa • New Orleans • Kansas City

price of casein. A large demand also exists for phthalic resins but lack of oil and glycerine has held output there down to the neighborhood of 20 tons a month.

South African Plant Will Use Solexol Process

A NEW INDUSTRY will be added to South Africa's growing economy when a vitamin concentrating plant now building for Vitamin Sales Corp. of South Africa starts operations in January. The plant is located at Simonstown about 23 miles from Cape Town.

Soup fin sharks and ling cod, which are abundant in South African waters, will provide the raw materials for this plant. A large refining plant will concentrate the vitamin segment of this crude oil over 16 times while simultaneously decolorizing, deodorizing and removing the waxy substances which cause the vitamin oil to cloud at low temperatures.

The process to be employed is the new Solexol process developed by the M. W. Kellogg Co. of New York.

Indian Plastics Producers Seek Tariff Protection

THE SMALL but growing group of plastics manufacturers in India is making a strong plea to the Indian Tariff Board for a protective duty against imported plastics and a reduction in duty on molding powders and other raw materials.

All the 24 plastics manufacturers in the country are members of the All-India Plastics Manufacturers Association which plans to send a delegation to Britain and the U. S. next spring.

An association survey shows that there are about 80 compression molding presses in the country, the largest with a platen size of 27 in. by 30 in. Total pressure tonnage amounts to about 3200, or 40 tons per press. At present there are only half a dozen injection molding machines in the entire country, almost all of them prewar German models.

Monsanto Pty. Ltd., Will Expand Activities

REPORTING FROM Melbourne, McGraw-Hill World News says that Monsanto (Australia) Pty. Ltd., has obtained Treasury consent for an increase of its capital by £289,550 to £689,550. Dr. James H. Lum who was associated with Monsanto's Clinton Laboratories at Oakridge, Tenn., will act as managing director of the Aus-

FOUR REELS OF VEELOS REPLACE
316 SIZES OF ENDLESS V-BELTS
THE OLD-FASHIONED WAY
THE MODERN WAY
RIVE IT WITH A V-BELT
E IT BEST WITH VEELOS

Page 3—
New Veelos Catalog

See how VEELOS *on Reels* CUTS V-BELT INVENTORY *to a Fraction . . .*

Tested, Proved and Adopted by American Industry

WHEN you start using Veelos, the link V-belt, you stop buying spare sets of belts for each drive. You just don't need them. With only 4 reels of Veelos you can replace as many as 316 sizes of endless V-belts. Any length belt for any drive is easily uncoupled from a reel, quickly made endless and installed. Never again will you see an unused V-belt deteriorating in stock. Reels of Veelos take up little storage space . . . simplify stock records.

These are just a few of the many outstanding advantages of Veelos on reels explained in the new Veelos catalog. You'll also learn why Veelos costs far less to install, cuts machine downtime, ends the woes of endless V-belts. *Send for your free copy right away.*

MANHEIM MANUFACTURING & BELTING COMPANY
MANHEIM, PENNSYLVANIA

VEELOS
THE LINK
V-BELT

Adjustable to any Length
Adaptable to any Drive

Known as VEELINK outside the United States

PREMIER

—better products more profitably processed the COLLOID MILL with PROVEN ADAPTABILITY

Dispersing solids in liquids or liquids in liquids, Premier insures more finely divided colloidal suspensions and promotes immediate chemical reaction.

Disintegrating solid particles or the fibre and cellulose in animal or vegetable tissue — instantly exposing these particles to the wetting or extractive action of the suspending liquid.

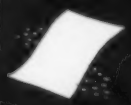
Emulsifying — achieving non-separating emulsions of all viscosities.

Homogenizing —assuring superior homogenized products by compelling uniform distribution of the dispersed phase throughout the mix.

Part of the Proof is In These *Industries*

Textile Mills

Rayon Plants


Paper Mills

Paint Manufacture

Cosmetics and Toilet Preparations

Drugs and Sanitary Chemicals Plants

Petroleum Products Plants

Rubber Products Plants

CLIP COUPON FOR MORE DATA

PREMIER MILL CORPORATION
211 GENESEE ST., GENEVA, N. Y.
SEND DESCRIPTIVE CATALOG

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

FLUID_____

tralian subsidiary. Most of the new capital will be subscribed by Monsanto Chemicals Ltd. of England. Profits on these shares will not be subject to double taxation as they continue to be on straightout U. S. investment in Australia.

The new capital will be used to double output of phenolic molding powders and to expand the sulpha drug line. Other key products expected to profit from the expansion are salicylic acid and aspirin. A new plant is going up at Braybrook, Victoria. Acquisition of I. F. Laucks Inc. by Monsanto will be duplicated in Australia by amalgamation of Laucks Australia Pty. Ltd., Brisbane, and Monsanto Australia. Laucks Australia makes cold water glues and resins for bonding of plywood.

France Discovers New Potash Deposits

DURING the Congress of the French Association for the Advancement of Science held at Biarritz from September 23 to 27, M. Georges Kimpflin gave an extensive report on the newly discovered potassium deposits in the Landes region. These deposits were brought to light in the course of oil-prospecting operations now being carried on in this area.

The Montcut pit, in southwestern France, some one and one-half miles from Dax, where the principal prospecting was done, is now being exploited by modern methods. One hundred tons of sylvite are being extracted from this pit every day. It is estimated that the deposit contains 600,000 tons of sylvite. A second vein is also being explored at Moncut and a third near Boudigot.

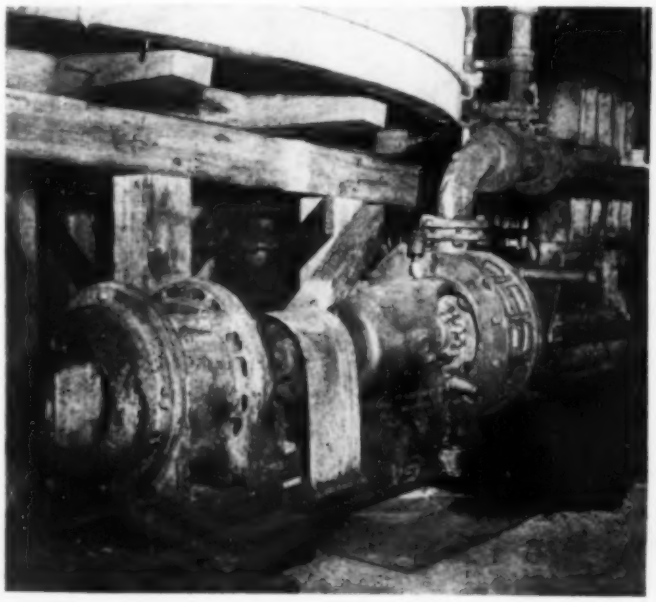
Russia Uses Plastic As Leather Substitute

AIMING to increase the annual Soviet shoe output to 250 million pairs by 1950, and confronted with livestock resources estimated as inadequate to supply the necessary 25 million calf hides annually, Soviet planners are promoting the output of a leather substitute identified as "polychlorvinyl fabric," a plastic recently developed in Russia.

A new machine that can produce this artificial leather like rolls of print paper at the rate of 1,500,000 meters per year has been created by the Russian engineer P. F. Sapilevsky, the inventor of the new plastic which is already being utilized on a small scale in making shoe uppers. Production of suitable substitute material for shoe uppers has been a bottleneck.

THE CORROSION FORUM

Edmond C. Feller, ASSISTANT EDITOR



Sodium Chloride versus Construction Materials

Part II of a symposium in which typical materials of construction are evaluated for services involving sodium chloride. Part III will be published next month.

←High-silicon iron pump used to handle 5 percent brine in a chemical plant. It has been in continual service for four years with no noticeable corrosion.

HIGH-SILICON IRONS

WALTER A. LUCE
The Duriron Co., Inc.
Dayton, Ohio

HIGH-SILICON irons have been successfully used as materials of construction for many years in applications involving sodium chloride solutions as the corrosive medium. The excellent corrosion resistant properties of these alloys apply for solutions at all concentrations and temperatures.

The most common of the high-silicon irons, Duriron, has a nominal chemical composition of 14.5 percent Si, 0.75 Mn, and 0.90 C max. An addition of 3 percent Mo to the above analysis results in increased resistance to certain type solutions (sodium chloride solutions included), and the alloy is known as Durichlor. Both alloys are supplied in cast form only and due to their extreme hardness, are finished by grinding methods. Many forms of chemical equipment are produced from these alloys including pumps, valves, heat exchangers, heaters, jets, fans, ejectors, and pipe.

The type sodium chloride solutions normally encountered in service usually range in purity from straight brine solutions found in some food packing industries to complex solutions of which sea water is a notable example. As expected, solution contaminants tend to play an important part in the ability of the high-silicon irons to withstand corrosion. It is usually the combined effect of these contaminants with the sodium chloride that causes corrosion.

Numerous successful applications of Duriron in sodium chloride solutions have been recorded. A few will be cited at this time to exemplify typical uses to which the alloy may be put. Since cast iron parts give satisfactory resistance to cold brine solutions, the high-silicon irons are only occasionally used for this service except where purity of the solution must be maintained.

1. Hot brine is used in packing plants for processing olives. The brine is concentrated to 20-30 percent by weight and heated to the desired temperature (about 160 deg. F.) with Duriron heat exchangers. Duriron pumps and valves are also used in handling these hot brine solutions. In processing pickles, a 10-15 percent brine solution at 70-100 deg. F. is recirculated by means of Duriron pumps. Excellent service was reported in each case with no replacements needed.

2. Saturated salt brines in the production of commercial salt have been transported in Duriron equipment. Satisfactory service was reported at temperatures as high as 280 deg. F. To insure satisfactory service at this high temperature, facilities for warming the high-silicon iron equipment slowly prior to operation are sometimes needed to prevent damage from thermal shock. Operators experienced in handling the high-silicon irons can safely introduce hot solutions to equipment if the right temperature rise is observed.

3. A number of chemical plants use Duriron pumps, valves, and other equipment in handling various brine solutions. These brines are generally circulated prior to their use in various chemical reactions.

The molybdenum containing alloy, Durichlor, is usually preferred by the Duriron Co. in sodium chloride services, but the added cost of 3 percent molybdenum sometimes limits its use where Duriron will give satisfactory results. As shown by the examples above, Duriron may give comparable results in relatively pure brines. However, where appreciable amounts of such contaminants as chlorine (or other halogen gases) or hydrochloric

If you use
or Distribute
PRESSURE
REDUCING
VALVES
For
• AIR LINES
• PAINT SPRAY EQUIPMENT
• AUTOMATIC OILERS
• DRINKING FOUNTAINS etc.
Consider CASH-ACME's continued acceptance by the nation's largest manufacturers and jobbers during the past twenty-five years, as indicative of their satisfactory performance.
See your Mill Supply dealer—ask for CASH-ACME Automatic Valves.
Bulletin No. 144 available on request.
Manufacturing SPECIALISTS OF
CASH-ACME
Automatic PRESSURE CONTROL VALVES
A.W. CASH VALVE MFG. CORP.
6612 EAST WABASH AVE
DECATUR
ILLINOIS

Double pipe cooler for synthetic coffee, direct expansion, all tubing is stainless steel, polished inside. Ends are quick opening, designed for working pressure of 300 PSI, test pressure of 600 PSI. Ammonia in annulus.

fabricated by **DOWNINGTOWN IRON WORKS, INC.**

The Double Pipe Cooler is typical of Downingtown Iron Works' shell and tube fabrication. Performance is guaranteed on all units of our design, or we will be glad to fabricate equipment to your specifications and drawings. Downingtown is prepared to engineer and build special shell and tube equipment for refrigeration applications in the chemical and process industries, especially those involving special metals or alloys.

All Downingtown Refrigeration Products are built to A.S.M.E. Code, Par. U-69, to U. S. Navy or to U. S. Coast Guard Specifications as may be required.

Other custom-built exchangers can be fabricated by Downington of: Karbate, Aluminum, the Bronzes, Nickel and Monel and Finned and Bimetallic Tubes. Write for literature . . . your request will be given prompt attention.

NEW YORK OFFICE:
30 CHURCH STREET

DOWNINGTOWN IRON WORKS
DOWNINGTOWN, PA.
HEAT EXCHANGERS

acid are present, the Durichlor alloy gives superior service. A few typical uses for Durichlor are shown below:

1. Durichlor pumps are used in handling a sodium chloride and hydrochloric acid solution in the chlorination of rubber derivatives. Satisfactory service was reported although solution concentrations or temperatures were not divulged.

2. Durichlor equipment has given satisfactory service in handling chlorinated brine solutions from the cells in an electrolytic chlorine-caustic soda plant. Although an occasional case of pitting type attack was observed, Durichlor was preferred over other alloys for corrosion resistance and economical advantages.

CARBON, GRAPHITE

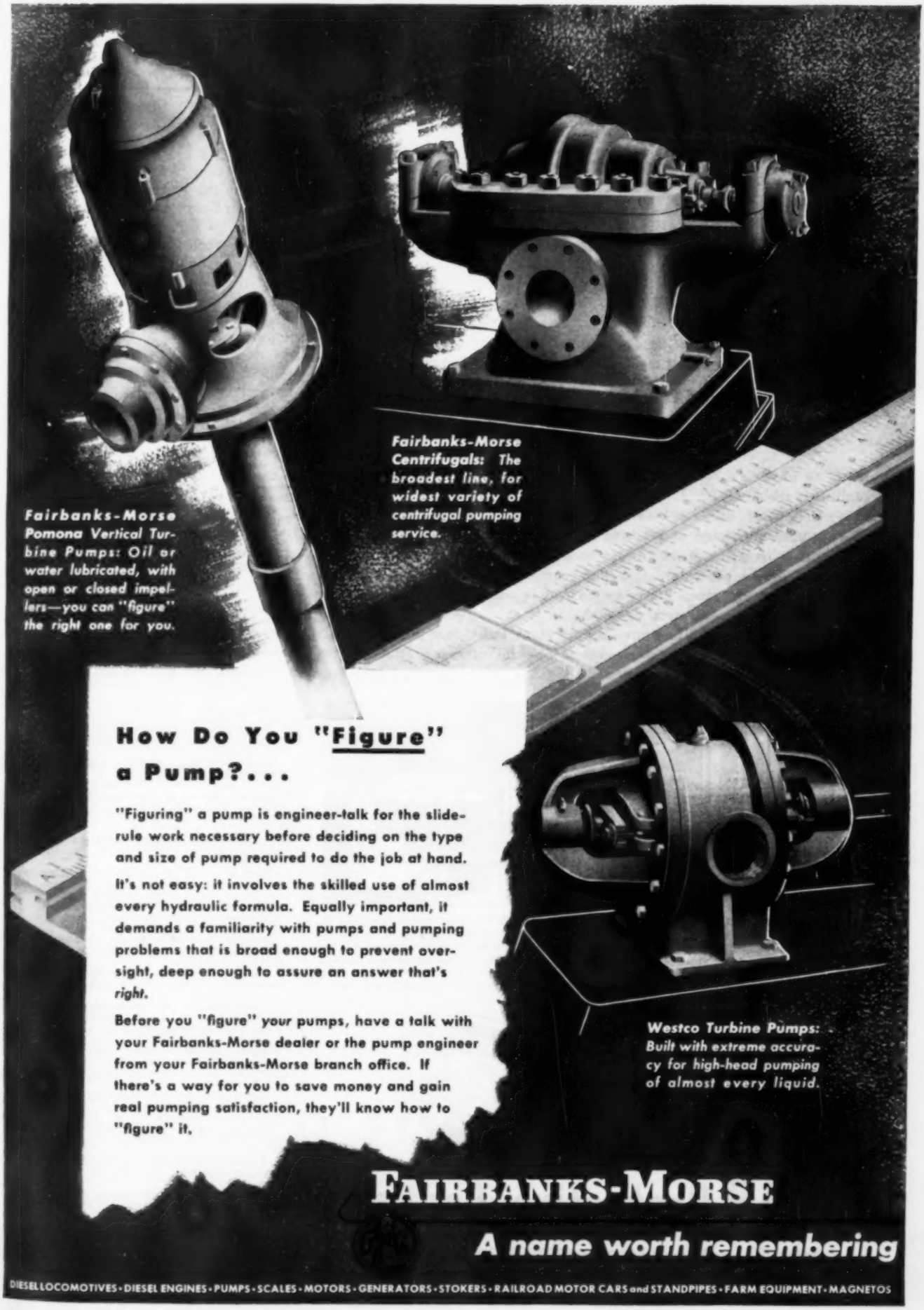
L. C. WERKING
National Carbon Co.
Cleveland, Ohio

CARBON and graphite are unattacked by sodium chloride, either dry or in aqueous solution at all temperatures. Karbate brand impervious carbon and graphite products are equally inert and may be used up to their normal operating temperature limitation of 340 deg. F.

The most extensive use of carbon products in contact with brine is the universal use of graphite anodes in caustic-chlorine cells. In this application, while there is a slow oxidation due to the products of electrolysis, there is no attack by the sodium chloride itself. A second and similar application is the use of graphite anodes in cathodic protection systems for condensers and pipe lines in sea water and salt marsh conditions. Here again any attack is due to products of electrolysis and may be regulated by the current density employed and minimized by the use of proper backfill material where such a practice is mechanically feasible.

The principal uses for Karbate products in contact with brine solutions are those involving heat transfer equipment of all descriptions, including concentric, bayonet, cascade and shell and tube types. The fact that Karbate equipment is unattacked, either by clean sea water or salt water contaminated by industrial wastes as found in inlets, backwaters, etc., make it almost universally applicable for cooling operations using sea water as the cooling medium. Maintenance of its normal physical characteristics at low temperatures has made for wide acceptance of Karbate cooling elements in refrigerated brine systems.

Karbate salt water cooling equipment is regularly used in such operations as cooling hydrochloric acid,



Fairbanks-Morse Pomona Vertical Turbine Pumps: Oil or water lubricated, with open or closed impellers—you can "figure" the right one for you.

Fairbanks-Morse Centrifugals: The broadest line, for widest variety of centrifugal pumping service.

Westco Turbine Pumps: Built with extreme accuracy for high-head pumping of almost every liquid.

How Do You "Figure" a Pump?...

"Figuring" a pump is engineer-talk for the slide-rule work necessary before deciding on the type and size of pump required to do the job at hand.

It's not easy: it involves the skilled use of almost every hydraulic formula. Equally important, it demands a familiarity with pumps and pumping problems that is broad enough to prevent oversight, deep enough to assure an answer that's *right*.

Before you "figure" your pumps, have a talk with your Fairbanks-Morse dealer or the pump engineer from your Fairbanks-Morse branch office. If there's a way for you to save money and gain real pumping satisfaction, they'll know how to "figure" it.

FAIRBANKS-MORSE

A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES • MOTORS • GENERATORS • STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT • MAGNETOS

Corrosion is no problem when you use

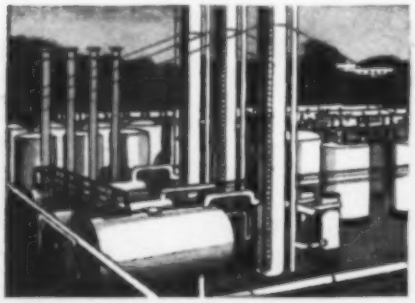
UCILON

Many users tell us UCILON 400 resists *more* corrosives for *longer* periods than any other coating they've ever tried!

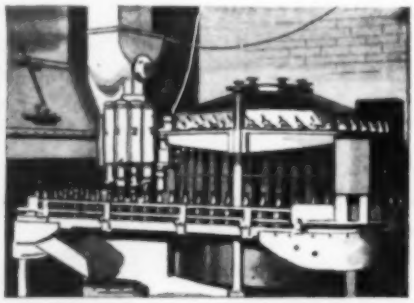
HERE, AT LAST, is a coating that really stops corrosion even where conditions are severest!

It's Ucilon *400*, a plastic base coating in the Ucilon group (which also includes aluminum and baking synthetic coatings). The inert synthetic resins in Ucilon 400 form a tough coating that resists both acids and alkalies, oil, water, alcohol and many solutions and fumes. It has excellent adherence, flexibility, no taste or odor when dry—and can be used on concrete, metal or wood.

Don't put up with half measures in your plant. Put Ucilon protective coatings to work on your own toughest job—and watch how effectively they stop corrosion-losses and cut costs.



A LARGE CHEMICAL PROCESS PLANT always had trouble protecting the exterior of pipelines which were exposed to caustic-fume-laden atmosphere. They ended their troubles with Ucilon 400. It's now 22 months since it was applied—and it's still going strong. No former coating had lasted even 6 months!



BOTTLING PLANTS all over the country are turning to Ucilon 400. In one plant, painting of bottling machines was considered to be almost useless—the job never lasted. Ucilon was tried. They now report that nothing ever used before even approaches the *2 years* Ucilon has been withstanding the high humidity and spillage!

SEND FOR THIS BULLETIN

It gives you more details on properties, types of coatings, application data. Write your nearest United Chromium office.

UCILON* Protective Coatings

UNICHROME products of UNITED CHROMIUM, INCORPORATED

*Trade-Mark Reg. U. S. Pat. Off.

51 E. 42nd St., New York 17, N.Y. • Detroit, Mich. • Waterbury, Conn. • Chicago, Ill. • Dayton, Ohio • Los Angeles, Cal.

hydrochloric-sulphuric mixtures, phosphoric acid, and chlorinated hydrocarbons mixed with hydrochloric acid.

Cathodic Protection Symposium

TENTATIVE program for a Cathodic Protection Symposium, sponsored jointly by the National Association of Corrosion Engineers and the Corrosion Division of the Electrochemical Society, has been announced. The meeting will be held December 8, 9, and 10 at the William Penn Hotel, Pittsburgh, Pa. Over 20 papers are scheduled covering theory, current density requirements, use of galvanic anodes, use of impressed current, and application of cathodic protection to underground structures, chemical equipment, water tanks and marine structures. The program:

Principles of Cathodic Protection, R. H. Brown, Aluminum Co. of America.

Characteristics and Field Use of Electrical Instruments, M. C. Miller, Ebasco Services, Inc.

Half Cells as Reference Electrodes, P. Fugassi, Carnegie Institute of Technology.

Laboratory Methods for Determining Current Required, R. B. Mears and J. M. Bialosky, Carnegie-Illinois Steel Corp.

Null Method of Determining Current Density Required, R. F. Hadley, Susquehanna Pipe Line Co.

Detection, Measurement and Mitigation of Stray Currents, F. B. Fry, Public Service Co. of Colorado.

Detection and Measurement of Currents Other than Stray, Lyle Sheppard, Shell Pipe Line Corp.

Advantages and Disadvantages of Various Current Sources, G. R. Olson, United Gas Pipe Line Co.

Choice and Installation of Anodes, Derk Holsteyn, Shell Oil Co.

Fundamental Characteristics of Zinc Galvanic Anodes, E. A. Anderson, New Jersey Zinc Co.

Characteristics of Zinc and Aluminum Anodes in Sea Water, T. P. May, U. S. Naval Research Laboratories.

Fundamental Characteristics of Aluminum Galvanic Anodes, E. D. Verink and R. B. Hoxeng, Aluminum Co. of America.

Fundamental Characteristics of Magnesium Galvanic Anodes, A. Smith, Dow Chemical Co.

Behavior of Experimental Zinc-Iron Couples Underground, I. A. Denison, National Bureau of Standards.

Practical Use of Galvanic Anodes, H. Walquist, Ebasco Services, Inc., and H. M. Fanett, United Gas Corp.

Application of Cathodic Protection to Process Equipment, Electro Rust-Proofing Corp.

Relations Between Coatings and Cathodic Protection, Guy Corfield, Southern California Gas Co.

Coordination of Cathodic Protection Installations to Avoid Interference with Adjacent Structures, L. B. Nelson, Shell Pipe Line Corp.

Cathodic Protection in Control of Stress-Corrosion Cracking, H. J. McDonald and R. D. Misch, Illinois Institute of Technology.

Rectifiers as an External Source of Protective Currents, F. A. Waelterman, Benwood-Linze Co.

Mitigation of Corrosion on Underground Cable Systems, L. J. Gorman, Consolidated Edison Co. of N. Y.

Potential Distribution in Cathodic Protection Systems, Gordon N. Scott, Consulting Engineer.

Wind Driven Generators as Source of Current, M. L. Jacobs, Jacobs Wind Electric Co.

Engine Driven Generators as Source of Current, Lon Wainman, El Paso Natural Gas Co.

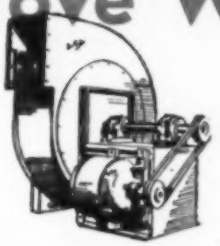
Field Methods, Other than Null Method, for Determining Current Required, N. P. Peifer, Mfrs. Light and Heat Co., Pittsburgh.

CONTROL DUST TO

1 Improve Working Conditions!

"Buffalo" EXHAUST FANS

These new highly efficient exhausters have smooth, all-welded housings. Bulletin 3576.

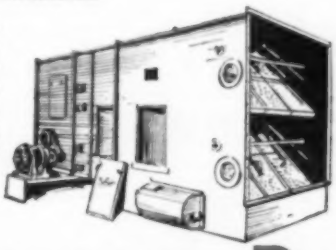


Control of dust in your plant or shop can make a big difference in working conditions! "Buffalo" Exhausters remove harmful dust, fumes, abrasives, etc., from the air—cut employee sickness and absenteeism to a minimum. "Buffalo" Exhausters require very little maintenance and make your power dollars go much farther.

2 Raise Product Quality!

"Buffalo" WET GLASS CELL AIR WASHERS

These units wash the air and filter it through spun-glass filters . . . removing over 98% of the dust. Bulletin 3457.

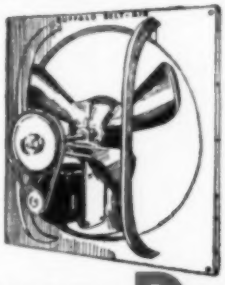


When your product must be kept free of air impurities, many manufacturers have found that "Buffalo" Wet Glass Cell Air Washers play a big part in maintaining uniform high quality. Besides keeping atmosphere free of practically all dust, these units can also provide humidification, cooling or heating, as desired . . . for further control of your product quality. For complete facts, write for Bulletin 3457.

3 Increase Production!

"Buffalo" DISC FANS

Available in belted or direct motor drive, "Buffalo" Breeze and Belt-Air Fans operate quietly and at negligible cost. Bulletin 3222-D.



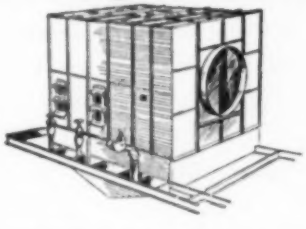
Many a ventilation system has its smoky, dead air spots . . . where production lags! Workers can't do their best in a stifling atmosphere.

By spotting "Buffalo" disc-type fans in these areas, you can bring live, fresh air to every worker very economically . . . clear the air of dust and fumes . . . and step up production. These "Buffalo" Fans are easily mounted on outside walls, where they do a steady, thorough job of drawing the bad air OUT. You'll find complete facts in Bulletin 3222-D. Write for it, for your files.

4 Salvage Dust!

"Buffalo" AIR WASHERS

These air washers are available in several types, for collecting valuable or dangerous dusts.



Many industrial processes require thorough recovery of valuable by-product material in dust form. Here, you will find Buffalo Type "DE" and "TE" Static Washers the low-cost answer. Extra sets of scrubbing plates insure complete collection, in a settling tank, either manually or automatically flushed out. Facts on the several models will be found in Bulletin 3142-C. Write for your copy!

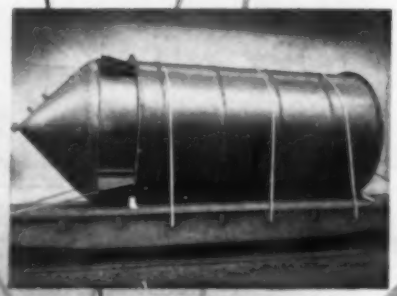
BUFFALO FORGE COMPANY

501 BROADWAY BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

Equipment For Dust Collection



Tar Base Extraction Tank, fabricated of Monel Metal; 10'-0" diameter, 25'-7" high.

PRESSURE

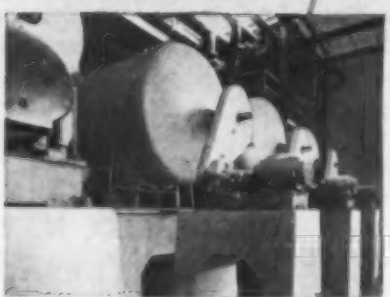
IN EVERY APPLICATION

Lead-Lined Jacketed Kettles with Lead Coils and Lead-Sheathed Agitators

Evaldar Digestor, pressure type, 19" dia., 29' lg. A.S.M.E. Construction, removable tube bundles.

Acme recognizes that the safe and efficient design of a vessel for high pressure or high vacuum service demands a complete consideration of all functional and mechanical requirements. For over a quarter of a century, Acme engineers and craftsmen have produced pressure vessels that have met successfully every requirement. Where necessary, Acme vessels are fabricated in accordance with A.S.M.E., A.S.M.E.-A.P.I. or T.E.M.A. Standards.

WRITE FOR BROCHURE CE-48



High-Pressure Grain Cookers.

ACME

Processing Equipment

ACME COPPERSMITHING & MACHINE CO., ORELAND, PA.

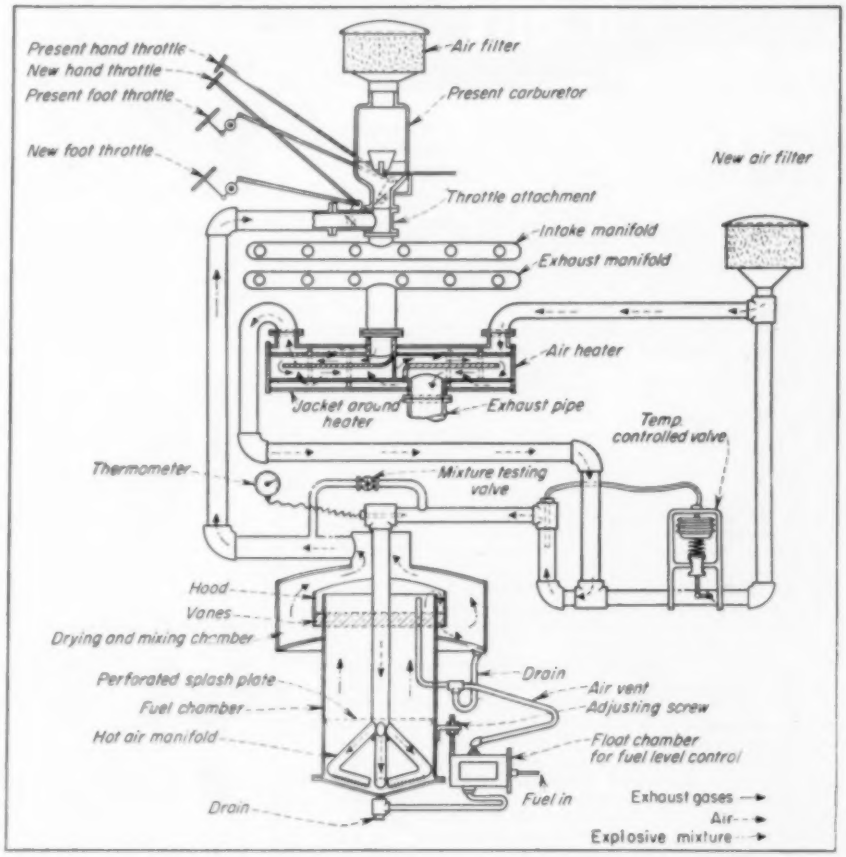
FROM THE LOG OF EXPERIENCE

Dan Gulleben, ENGINEER

A HIGHBALL and propitious circumstances can have tremendous effect. Chief Engineer Paul De Vries of the Revere Sugar Refinery on the River Mystic in Charlestown sat in a friend's kitchen one cold night in '32 enjoying the spiritual uplift of a cocktail. A kerosene stove was heating a polished chrome steel tube to orange brightness and thereby radiating warmth to supplement the highball. Suddenly Paul had an inspiration. A couple of days later he replaced one of his cast iron char retorts, ¾ in. thick and 8 ft. long weighing 600 lbs., with three 3-in. tubes 0.0188 in. thick of 17 chrome sheet steel weighing 15 lbs. The pyrometer indicated a temperature of 1,100 deg. F. Directly chemist Jim Brown came in with a long face and reported that the three sample thin tubes were everburning the char. Paul laughed in Jim's face. Straightway he refitted one 80-retort kiln with triplets of chrome steel tubes and the results with 900 deg. were equal to the former 1,100 deg. operation, as Jim himself readily agreed. Within a few years nearly every char kiln in the land adopted Paul's inspiration.

THE OLD RETORTS cost $25 each plus three hours for the labor of installation and they had a life of seven years. The chrome tubes cost $9.75 per triplet and the labor of installation was one hour. The expectancy is not yet known. After 14 years of service there is no indication of distress. They can endure more heat but, because of their thinness, require less. The reduced temperature effects a saving in fuel oil of about one barrel per day per kiln.

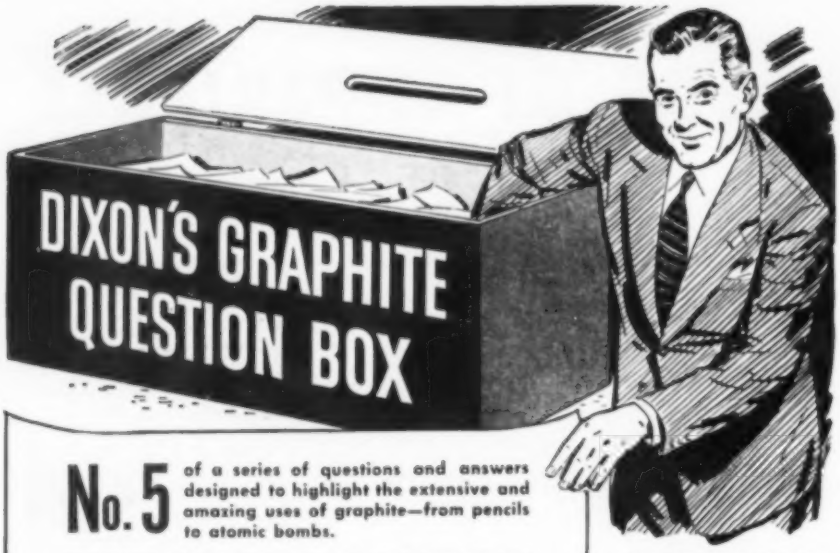
Now, on the assumption that there are 400 kilns in operation and that they work 250 days a year, a little arithmetic indicates that in the 14 years since Paul's inspiration there has been a saving for the benefit of the great American consumer of three and a half million dollars. Furthermore on the statistical day after the 14th anniversary, the 400 kilns would have to install 9,600 tons of cast iron retorts at an expenditure, based on old prices, of a million two hundred thousand dollars. Nevertheless, let no man offer to justify Paul's cocktail against the year's American liquor bill of seven billion dollars.



During the war Paul De Vries rigged his car to run on fuel oil, with a little help from gasoline on warm-up and acceleration. Cut shows fuel oil carburetor

TO HEAT Paul's retorts on Monday morning, the firemen get two hours overtime as against four hours with the thick cast iron retorts. The reduced operating temperature decreases the maintenance of the brickwork. Frank Harvey avers that if 286 kilns were operated seven-day weeks instead of 400 at five-day weeks, and char storage space were provided over the weekend, the maintenance could be further decreased by avoiding the weekly strain of cooling and heating.

DURING THE WAR Paul had a desire to relax on week ends. His New Hampshire farm, 50 miles away, offered relief from the five-day grind at the refinery. It was in fact in the public interest that he follow his desire since clarity of mind induced improved output and this in turn promoted the war effort. However his gasoline ration could not be stretched and his ethics as well as his respect for his car forbade the use of black market gas. On the other hand there exists no black market nor any moral or legal consideration that can restrain mechanical ingenuity. The circumstance of a legal ration of kerosene and light fuel oil for heating his town house and a plentiful stock of ration-free fire wood at the farm suggested to Paul a solution. Accordingly he installed a tank for fuel oil in the trunk compartment of his car and provided under the engine hood a unique car-



No. 5 of a series of questions and answers designed to highlight the extensive and amazing uses of graphite—from pencils to atomic bombs.

HELPFUL ANSWERS FOR TECHNICIANS AND PRODUCT ENGINEERS

QUES. What are some of the qualities of graphite which have earned for it a reputation of being one of the most versatile minerals?

ANS. 1. As a lubricant it can be used in dry powdered form or as an additive, being available in particle sizes from 2 microns to large flake sizes containing particles from 1/3 to 2 millimeters.

2. It is available in concentrated form in various types of vehicles to produce suspensions for varying functions.

3. It can be incorporated in powder metallurgy processes to produce oilless bearings, and in iron powder metallurgy to produce preformed steel parts of high tensile strength.

4. It withstands excessively high and low temperatures, high pressures and operating speeds, and its chemical inertness makes it insoluble in all other known substances.

5. Graphite rates high as an efficient conductor of heat, as evidenced by its long and increasing usage in producing crucibles, retorts, molds and refractories.

6. Graphite is an efficient conductor and controller of electricity, resulting in its wide usage in producing self-lubricating motor and generator brushes, dry batteries, electrodes, resistors, television cathode tubes and other products in the electrical and electronic fields. Graphite is also widely used as an electrical conductor in electroplating processes.

7. Because of its resistance to chemical and temperature decomposition, graphite is widely incorporated as a pigment in protective coatings and paints.

8. Graphite adheres readily to other substances and materials but does not permit other substances to adhere to it. That is why its services as a coating or separator on foundry sand, aluminum and other types of molds are widely recognized.

9. Graphite is incorporated in steel to raise the carbon content.

10. Graphite, because of its heat-resisting qualities, is used in steel liquid hardening baths, and in somewhat similar techniques in the production of iron and steel.

11. Graphite is non-toxic and does not permanently stain or discolor other materials. Applied in some forms it produces a sleek, silvery, light-reflecting surface when rubbed or combined with transparent vehicles.

A few of thousands of widely used products containing Dixon's Graphites. Those starred are Dixon's products, many of them sold by supply houses everywhere.

★ Crucibles

★ Pipe Joint Compound

★ Graphite (pipe joint) Seal

Now may we receive *your questions* on how graphite can help *you*?

DIXON'S GRAPHITES

Products of

JOSEPH DIXON CRUCIBLE COMPANY

Jersey City 3, N. J. Div. 243-Q-11

LOOK FOR No. 6

in this series. We will gladly send you reprints of any you may miss.

buretor in the shape of a container. The container was supplied with fuel oil to a controlled level, while at the same time a small electric driven pump drew oil out of the bottom and returned it in the way of a fine spray at the top. Furthermore a heat exchanger was contrived to heat air by means of exhaust gas. The hot air bubbled through the oil at the bottom of the container and swept the space above, counter to the spray, after the manner of a scrubber and thereby became saturated with oil. Now the total quantity of oil that the air will absorb is a function of the temperature; the hotter the air, the more oil. Paul required a balanced fuel-air mixture so as to have just the right amount of oxygen to combine completely with the combustible ingredients of the oil. This he obtained by adjusting the temperature of the air by trial and error until the quantitative analysis of the mixture indicated perfection, which to a wizard like Paul is simple enough. The heat exchanger, having surplus capacity, superheats the air and this is tempered by means of a control valve that admits cold air to attain the correct final air temperature. The fuel-air mixture enters the intake manifold by way of a T just under the old carbureter, being controlled by means of a butterfly valve with linkage to an auxiliary "accelerator" foot pedal.

THE ENGINE could not start with Paul's device and he could not maintain the minimum idling speed while the engine was cold. But, having started in the regular way and warmed up his engine, he could swing his toe to the auxiliary accelerator and draw hot, balanced fuel-air mixture into the cylinders and thereby attain any desired speed according to the opening of the butterfly valve. The standard carbureter at minimum gasoline injection maintained idling speed while waiting for street signals. However he could set the hand control for idling with fuel oil. In congested traffic he could swing to gasoline since acceleration at speeds below 25 mph. was too slow and aggravated Paul's impatience. Above the 25 mph. speed, acceleration on fuel oil equaled that on gasoline when the road was level but on a hill the engine had a tendency to knock. After he passed 30 mph. the knock disappeared and further acceleration was accomplished with equal facility whether he used oil or gasoline. By occasion, as can happen with any driver, his gasoline tank unexpectedly ran dry and he has made the entire 50 mile journey without a drop of gasoline in the tank except only enough to warm the engine at the start.

"80% of all part replacements in our machines could have been avoided by proper lubrication"

says the Chief Engineer
of a large machine tool manufacturer

LET a GULF LUBRICATION ENGINEER help you find opportunities for big dollar savings in your plant

"WE KEEP TRACK OF ALL REPLACEMENT parts ordered for our machines—and we investigate the cause of each failure," says this Chief Engineer. "We've found that 80 per cent of all these replacements can be avoided by proper lubrication."

What percentage of your part replacement bill could be saved? Let a Gulf Lubrication Engineer work with you to find out! He will recommend the proper lubricants and the most suitable methods of application, help you set up a tailor-made lubrication program, and suggest ways and means to eliminate contamination of lubricants. As a result, you'll get less wear, reduced down time—and a big savings in repair bills.

The services of a Gulf Lubrication Engineer—and the Gulf line of more than 400 quality lubricants—are available to you through 1200 warehouses in 30 states from Maine to New Mexico. Write, wire, or phone your nearest Gulf office.

GULF INDUSTRIAL LUBRICATION

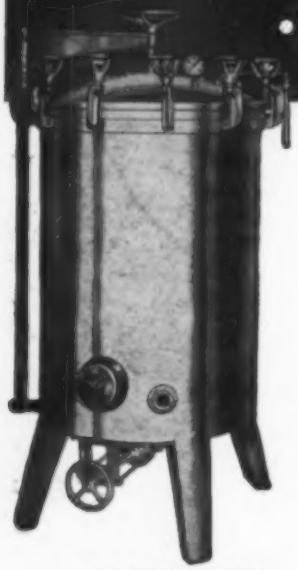
Gulf Oil Corporation · Gulf Refining Company

Division Sales Offices:

Boston · New York · Philadelphia · Pittsburgh · Atlanta
New Orleans · Houston · Louisville · Toledo

The Heart of a Good Filter is its FILTER LEAVES!

You Can Depend On
KLEIN
FILTERS and FILTER LEAVES
• Positive Filtration . . . No Clogging
• Full Drainage



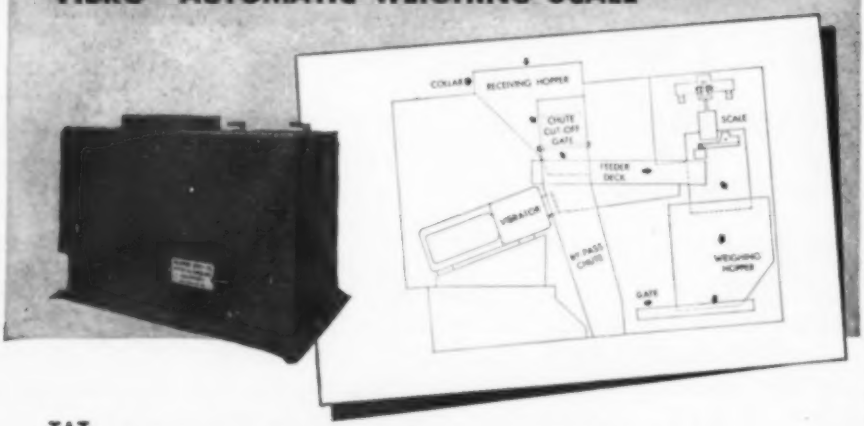
Klein Ideal Diatomaceous Earth Filters and the exclusive Klein Filter Leaves, in combination, assure positive filtration at all times. Operation, cleaning and maintenance costs are at a minimum with Klein Filters. In addition, many radical innovations are incorporated in Klein Ideal Filters. You'll want to know about all of these if you have an industrial, chemical or food filtration problem in your plant.

Write for latest Klein Bulletin

Klein Filter Leaf—If damaged, metal cloth easily replaced. No rivets. Note horizontal headers—central duct—Klein Cleanout Cap.

Established 1909
KLEIN
FILTER & MANUFACTURING COMPANY
1225-29 School Street • Chicago 13, Ill.

No Troublesome Belts . . . IN THE BEAUMONT
"VIBRO" AUTOMATIC WEIGHING SCALE



WHY bother with belts, pulleys and motors in weighing scales?

The stainless steel vibrating feeder in the Beaumont "Vibro" Automatic Weighing Scale has no belts or moving parts—eliminates faults. It is particularly well adapted to very abrasive materials and the rate of feed can be easily adjusted by a rheostat controlling the vibration of the feeder.

Other features include: high weighing accuracy, feeder capacity from 1 to 60 tons per hour, dust proof construction, quiet operation and long life. We can promise prompt shipment on standard units. Write for descriptive bulletin.

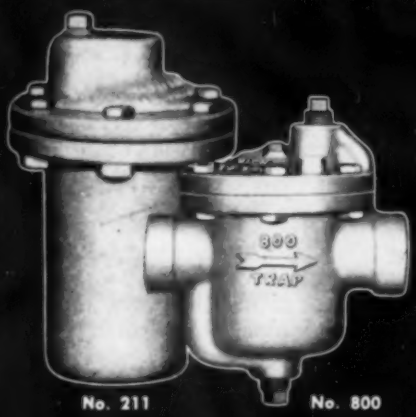
BEAUMONT BIRCH *Company*
1510 RACE STREET—PHILADELPHIA 2, PA.
Designers Manufacturers Erectors BULK MATERIAL HANDLING SYSTEM

MILEAGE PER GALLON of fuel oil exceeded that for gasoline since the fuel oil has a higher calorific value. Furthermore, since the balanced fuel-air mixture is drawn into the cylinders in quantity according to the need for power, it is more efficient than the ordinary gas engine fuel feed wherein the gasoline injection is controlled but the air is not. For the average range of speed and power the proper amount of gasoline is drawn in but outside of this range, gasoline is admitted wastefully. Flooding of the cylinders is not possible with Paul's carbureter. However for the sake of practicability, the standard arrangement is universal. Paul's complexity responds more effectively under the intellect and skill of an engineer.

THE WEEKEND TRIP to New Hampshire required much less fuel oil than he saved by cutting down the town house thermostat to the minimum for plumbing protection and besides the fuel oil consumption was still further reduced by the weekly load of wood from the farm. The neighbors sneered and suspected but the Ration Board could have had the explanation for the asking. Paul's speedometer showed more mileage than was allotted to him but the proof of his probity was his unused ration stamps for both gasoline and fuel oil.

A BROKEN PUMP SHAFT once required service at a public garage. When he called for his car, the entire staff of mechanics was prying under the hood in wonderment at the perplexity of piping. He led them to believe that it was a heating arrangement but the mystery was locked up in the trunk compartment and in the United States Patent Office (No. 2,384,609). At the end of the war Paul removed the auxiliary fuel oil tank and reverted to the good old American pattern of simplicity and extravagance.

AS AN ENGINEER Paul stands out, but in physical qualities he is on a par with the rest of us. On one occasion he called at our plant to engage in the universal sugar house practice of interchanging ideas. The noon period slipped by without the conventional pause. Not being addicted to the habit of lunch; the chronicler had inconsiderately overlooked it. For a subsequent visit, however, preparation had been made with a supply of sandwiches stored in the desk drawer. When lunch time arrived we extracted the sandwiches and invited participation. Paul declined with thanks. He said he recalled the pangs of hunger that he had suffered on his last visit and had



No. 211 No. 800

Above left — Armstrong bottom inlet—top outlet series trap.

Above right — Armstrong No. 800 side inlet—side outlet trap.

PROOF OF FASTER HEATING WITH ARMSTRONG TRAPS

20% REDUCTION in heating-up time of corrugating and pasting machines since installing thirty Armstrong No. 211 traps. —*Toronto Container Gair Co., Toronto, Canada.*

•

HEATING-UP TIME of cross-circulating lumber kiln cut in half after putting individual traps on each pipe coil.—*Riverdale Millwork Co., Chicago, Ill.*

•

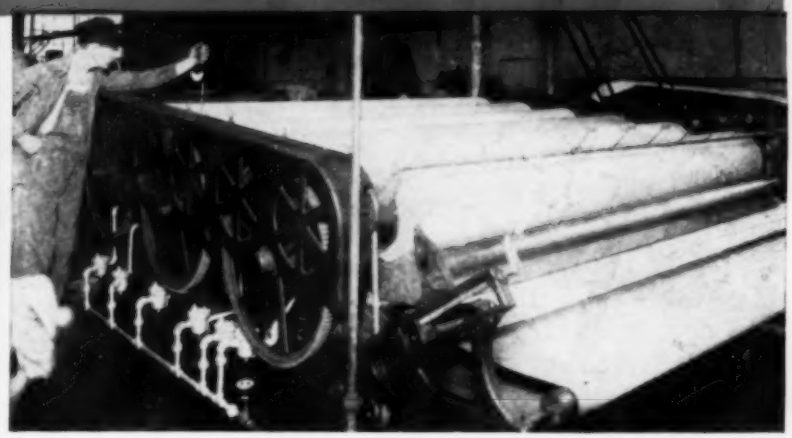
TWO HOURS heating-up time and 10% fuel savings effected since installing Armstrong traps on all steam heated equipment.—*Robertson's Laundry and Dry Cleaners, Sault Ste. Marie, Michigan.*

•

30% CUT in time required to bring 240 gallon jacketed kettles in canning plant to boil since equipping each with an Armstrong trap. — *Bulman's Ltd., Vernon, B. C.*

For Fuel Savings and Maximum Production

CHECK YOUR EQUIPMENT TEMPERATURES!



Taking flatwork ironer temperatures with an indicating pyrometer.

Are the temperatures of your steam heated equipment as high as they should be at the steam pressure you are using? It pays to find out!* If temperatures are below normal *you are losing money* in two ways:

1. *You are losing production* because it takes improperly heated equipment longer to do the work.

2. *You are wasting fuel* because low production means longer hours for non-productive radiation losses from steam supply and return lines.

Faulty trapping is a common cause of low temperatures (see table below). Armstrong Steam Traps have corrected this waste in hundreds of plants because they remove condensate just as fast as it accumulates, thereby letting steam into the equipment to keep it hot. Equally important, Armstrong traps discharge air along with the condensate. Air, always present in steam, reduces steam temperatures and heat transfer rates. Send for the Armstrong Steam Trap Book for complete data on selection, installation and maintenance. ARMSTRONG MACHINE WORKS, 858 Maple Street, Three Rivers, Michigan.

Typical Cause of Low Temperature	Remedy*
1. Traps not designed with adequate air handling capacity.	Install Armstrong traps which automatically discharge all air along with condensate.
2. Traps not installed properly.	Follow instructions in Steam Trap Book.
3. Undersized traps or traps used on pressures above their ratings.	Use trap sizes recommended in Steam Trap Book.
4. Attempting to drain more than one unit with a single trap.	Install an individual Armstrong trap on each steam heated unit.
5. Leaky traps blowing through.	Repair or replace traps

*An Armstrong representative specializing in condensate drainage can help you get to the heart of the trouble in a hurry.

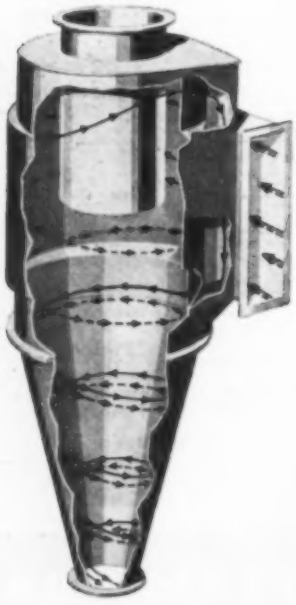
ARMSTRONG *Inverted Bucket* STEAM TRAPS

No. 1 of a series of advertisements devoted to improving efficiency through better trapping.

PREVENTING

Dust Losses

Pinning one's faith to a proposed dust collection system is no casual matter. You want to be as sure of the engineering as you are of the equipment itself...Buell has a wealth of experience to lay on the line, and 100% of it in this specialized field. Fundamental, too, is the fact that each and every Buell installation is engineered and built for the special conditions under which it is to operate. Therein lies the secret of high-efficiency performance — and of greatest value per dollar of cost. To know Buell better, you ought to read the 32 pages of frank discussion in our new catalog.



Write: Buell Engineering Company
18 Cedar Street, New York 5, N. Y.

buell

Engineered Efficiency in DUST RECOVERY

therefore fortified himself with a generous lunch just before his arrival at our plant.

THE EMPLOYMENT department has fixed 65 as the age when the job loses the stimulating thrill. After that the old man has lived through all of the experiences. His work is done! Not so with Joe Berry. He merely changed horses when he retired from the Love Land sugar house in '45. The local cannery had gone broke and so the farmers' association had to do something about it. Joe proposed the idea to buy the defunct plant at ten cents on the dollar. Straightaway the farmers accepted his suggestion and appointed him president and manager. Here was a new thrill and Joe applied his perennial sugar house frugality with the pruning knife in one hand and intelligent maintenance in the other. The good results that followed were credited to good management but Joe admits that he got some help from O.P.A. The ceiling price on sugar was six cents a pound dry and, after the addition of cherries, it rose to 21 cents.

IN HIS YOUTH Joe was addicted to the practice of gaiety to the consternation of his family and the home town in general. This fact later came to plague him on inopportune occasions when he was administering discipline to his daughter and four sons. As in the case of the parson's son, undeserved blame sometimes attached to Joe just to maintain the general average. While George Shaffer was enlarging the Love Land factory in 1902, it was the custom of a group of constructors to relax boisterously in the village tavern. One Saturday morning the boys were tired and remained AWOL and Joe was among the absentees. George fired the whole gang. However he learned later that Joe was sick ("no foolin' ") and he grasped the opportunity to reinstate him. Joe's quality as a mechanic and the leaven of his morale-inspiring humor could not be spared.

MODES OF RECREATION indulged in by the old craftsmen must be judged by the times and the facilities. They did with their might what their hands found to do and alternately practiced relief which was condoned under the grandmotherly formula, "Boys will be boys." A certain agricultural attache shared offices with Supt. Herb Barringer. There were no secrets between Herb and the farmer but Herb felt some curiosity as to the degree of privacy of his mail that laid openly on his desk. Accordingly he composed a letter addressed to him-

Keeping impeller shafts in line helps keep maintenance costs in line

IN Roots-Connersville heavy-duty gas pumps, impeller shafts are held rigidly in line by Timken tapered roller bearings.

With Timken bearings on the shaft, there's no deflection or end-play. Gears mesh properly, preventing excessive wear. Timken bearings maintain correct internal clearances, eliminating possibility of wear or damage to the impellers and the case.

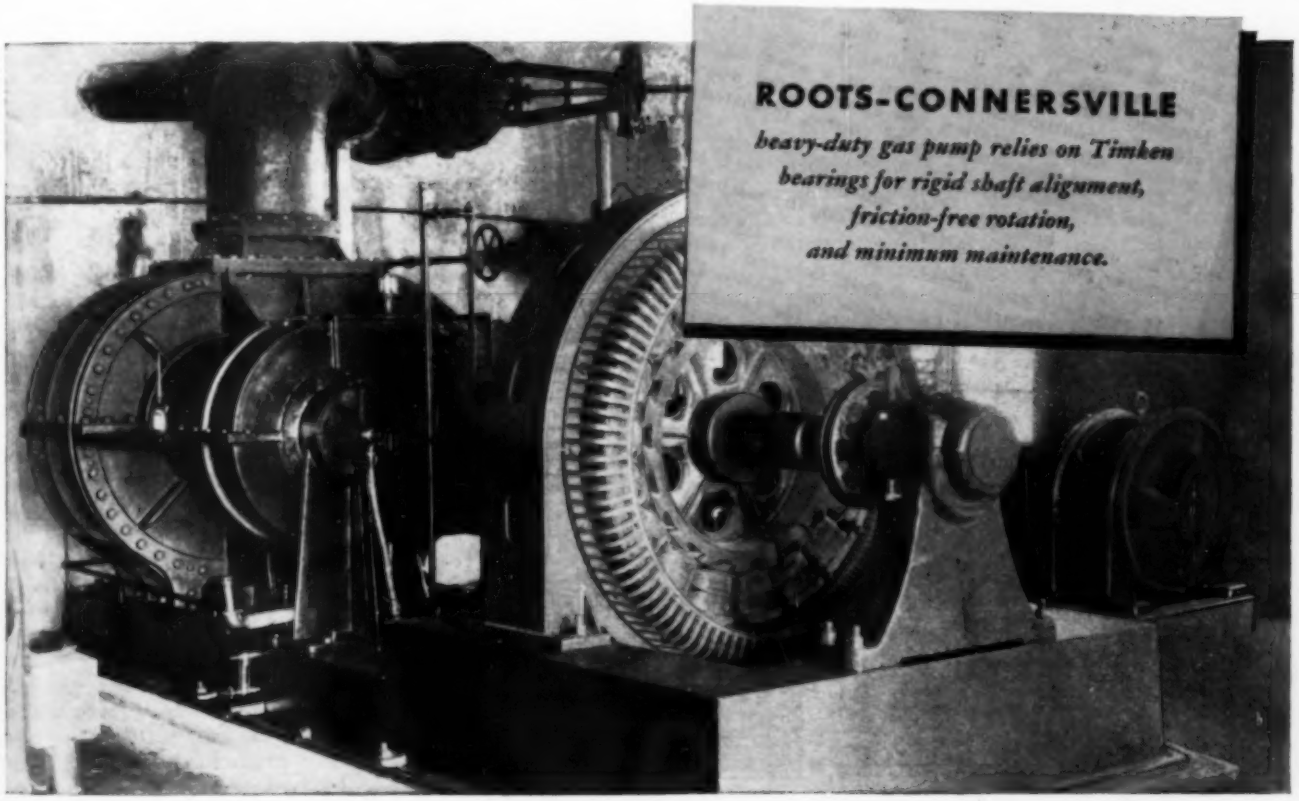
Timken bearings are manufactured to incredible precision. They retain that precision due to scientifically correct design and the finest material ever developed for tapered roller bearings — Timken fine alloy steel.

Since Timken bearings are tapered in construction they carry any combination of radial and thrust loads. The line contact between rolls and races provides a wide area of bearing support, preventing shaft deflection and affording maximum load capacity.

If the machines you make or use require friction-free shaft alignment that lasts under any combination of loads, make sure the trade-mark "Timken" is on every bearing you use. No other bearing brings you *all* the advantages you get with Timken bearings. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN BEARING EQUIPPED

This symbol on a product means its bearings are the best.


ROOTS-CONNERSVILLE
heavy-duty gas pump relies on Timken bearings for rigid shaft alignment, friction-free rotation, and minimum maintenance.

DESIGN LEADERSHIP

The first Timken tapered roller bearing was produced about 1898. Since then the one-piece multiple perforated cage, wide area contact between roll ends and ribs, and every other important tapered roller bearing improvement have been introduced by The Timken Roller Bearing Company.

The Timken Roller Bearing Company is the only bearing manufacturer in the country which makes its own steel, and leads in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels.

TIMKEN

TRADE MARK REG. U.S. PAT. OFF.

TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST →◫← LOADS OR ANY COMBINATION ✳

MARTIN CALCINER / PREHEATER

PROVIDES FOR RABBLING MATERIAL IN ATMOSPHERE TEMPERATURE UP TO 2500°F

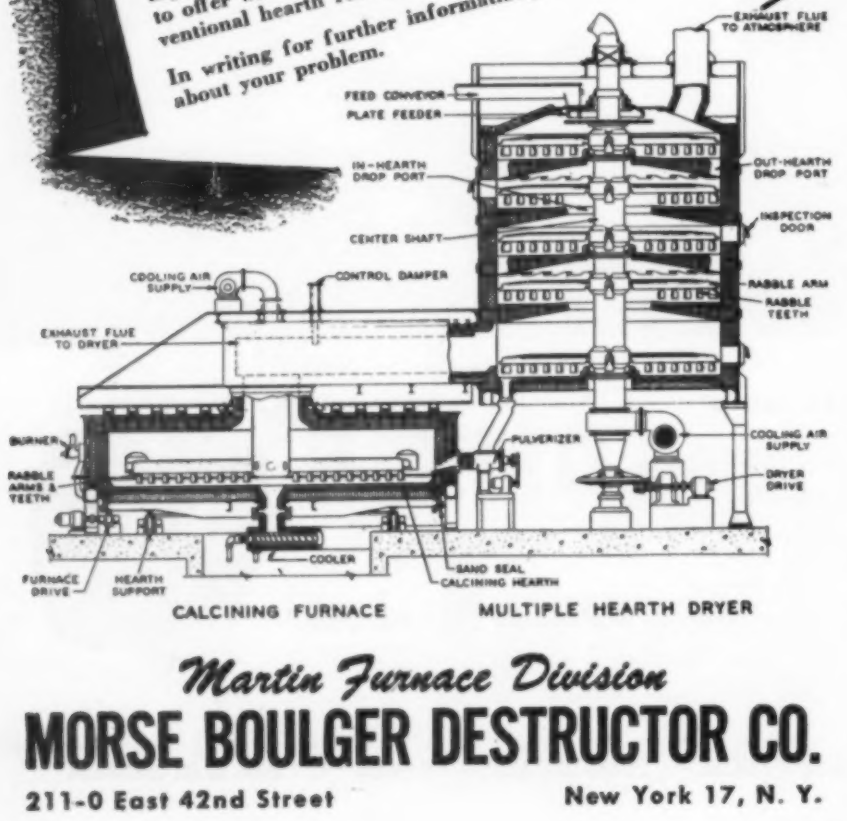
The conventional multiple hearth furnace is limited to temperatures of 1800° to 2000°F due to unavoidable conditions in which the fire brick hearths are subjected to heat from both sides.

By contrast, the calciner section of the Martin Furnace is designed to handle temperatures up to 2500°F. It's a single chamber furnace in which the brickwork can allow very high temperatures with durability and heating efficiency corresponding to other chamber type furnaces. It also has a rotating hearth in combination with a stationary rabbling device which provides for continuous operation in a most uniform manner without creating hot spots in the material bed. The stirring device is, of course, insulated and cooled internally.

The waste heat from the calciner is used to dry and/or preheat the material feeding the calciner.

If you have any calcining or roasting job which requires a temperature ranging between 1800° and 2500°F you should investigate the Martin Calciner/Preheater. If your process calls for lower temperatures, the multiple hearth section alone with its revolving rabble arms and fixed hearth has several things to offer which are great improvements over the conventional hearth furnaces.

In writing for further information, tell us in detail about your problem.



CALCINING FURNACE MULTIPLE HEARTH DRYER

Martin Furnace Division

MORSE BOULGER DESTRUCTOR CO.

211-0 East 42nd Street New York 17, N. Y.

self and signed by the G.M. in Denver. In this letter the G.M. proposed to abolish the farmer's job on the ground that it served no useful purpose. The letter was "carelessly" left face down on Herb's desk. In the afternoon Herb learned that the farmer had left the office precipitately and was in fact at home in a greatly depressed condition.

UNDER AN OLD CUSTOM Herb ordered a carload of coal on the Company's credit and price advantage for distribution between himself, Engineer Franklin, the farmer and the office manager. In due time the coal arrived and Herb observed the farmer and the office manager on top of the car directing the teamster to select the lumps for their share. He called Frank and the twain climbed the car. Herb critically examined a lump and called Frank's attention to certain yellow streaks. "These lumps," he declared "are the same dash-dash stuff that ruined our furnaces last winter." He berated the coal company for adding so much inferior lump to the excellent fines and then stormed away. Coal hauling continued but the lumps were left for Herb and Frank.

WHEN HERB was superintendent of a Northwestern factory in 1915, the IWW Bolsheviki essayed organization of the craftsmen in the sugar house. They announced their presence by driving steel spikes into the beets in the fields. When they thought they had thus sufficiently harassed operation and "softened" the operators, they circled the factory in the dark of the moon to prevent access to the midnight shift. When a hundred Bolsheviki had deployed opposite the front gate, Shift Supt. Ray White blew the whistle to signal the closing of the works. Then the entire operating crew marched out under Ray's leadership. The radicals, interpreting the shutdown as capitulation, cheered loud and long. As Ray's column stretched itself out to face them, man for man, Ray maneuvered himself into position in front of the king of the rabble. This exalted personage, misjudging the loyalty of the craftsmen, made offensive remarks. Straightway a swift blow from Ray's strong right arm laid him low. With this cue each craftsmen surprised his opponent, and great was the rout thereof. The Bolsheviki disappeared into the night and flung back threats of reprisal. The manager criticized his men's assumption of police attributes. Nevertheless when the radicals observed the applause of the folks and the sheriff, driving spikes into the beets ceased. Exit Bolsheviki. Enter tranquility.

NAMES IN THE NEWS

R. C. Gunness

R. Chelminski

J. R. Skeen

R. C. Gunness has been promoted to the position of manager of the research department of Standard Oil Co. (Ind.) and **T. H. Rogers** has been promoted to director of research. **J. K. Roberts**, general manager of research, who was recently made a director of the company, will continue to have general supervision over all research department activities.

H. C. Edwards, chief engineer of research and development, has been appointed director of research and development to succeed **J. F. Leahy** who retired last month after 45 years of service with The Timken Roller Bearing Co., Canton, Ohio.

Allan O'Neal, with The B. F. Goodrich Co. since 1929, has been named manager of the company's plant in Clarksville, Tenn.

Charles A. Wight, vice president of Bankers Trust Co., has been elected a member of the board of directors of Freeport Sulphur Co., New York.

Mark M. Luckens, recently discharged from the Army's Sanitary Corps with the rank of Major, has accepted a position as director of quality control, research and development with the Arizona Cooperative Date Producers Assn., Chandler, Ariz.

R. S. Neblett has been named administrator of the General Electric Co.'s nucleonics project, which consists of work on atomic energy for the U. S. Atomic Energy Commission.

Roman Chelminski, for many years associated with The Dorr Co. and more recently with the process division of General American Transportation Corp., has resigned the latter position to join Knowles Associates as a general partner.

Robert H. Bollinger is now in technical sales service with the Georgia Kaolin Co., Elizabeth, N. J.

Seymour C. Hyman has assumed his duties as lecturer in the department of chemical engineering of the College of the City of New York. Mr. Hyman was formerly chemical engineer with the Signal Corps Engineering Laboratories at Fort Monmouth, N. J., and prior to that with the Ashland Oil and Refining Co., Ashland, Ky.

T. G. Delbridge, noted petroleum chemist, has retired from The Atlantic Refining Co. after 38 years service with the company. Succeeding him as manager of the research and development department is **Hugh W. Field**, a member of Atlantic's board of directors and assistant manager of the department for the past seven years.

R. C. Stromquist has been appointed manager of the production department, tar products division of Koppers Co., Inc., Pittsburgh, Pa.

Hugh H. Mosher has been appointed director of organic research for the Quaker Chemical Products Corp., Conshohocken, Pa.

John R. Skeen has joined the staff of Foster D. Snell, consulting chemist and engineer, New York, as account executive in charge of market research. Dr. Skeen came to the Snell organization from the staff of the Bureau of Internal Revenue where he has been principal chemical engineer in the business and industries division of the income tax unit.

Stuart O. Fiedler has accepted a position in the research department of the Industrial Rayon Corp., Cleveland. He will remain a director of Bjorksten Research Laboratories, Chicago, but has resigned as manager of the South Chicago Branch.

Douglas M. McBean, consulting engineer and inventor, has been elected to the board of trustees of Clarkson College of Technology, Potsdam, N. Y.

J. L. Gray, formerly with the B. F. Goodrich synthetic rubber plant at Louisville, Ky., has been made superintendent of the Chemical Products Corp., Cartersville, Ga.

Vannevar Bush, former head of OSRD, has been appointed by the President as chairman of the Research and Development Board subject to confirmation by the Senate.

John W. Igoe has joined the headquarters staff of Bituminous Coal Research, Inc., to handle technical information service and edit the Bituminous Coal Research bulletin. He succeeds **Carl S. Westerberg** who has

Don't let fire-and-explosion risks slow up production!

• Are flammable vapors *normally* present in any of your processing, storage or handling operations?

If the answer is 'yes,' this new Flammable Vapor Detector *measures the margin of safety* continuously, to permit maximum production within safe limits.

• Can flammable vapors *accumulate* by accident or carelessness at any point in your plant or delivery facilities (including ships or carriers)?

If so, the instrument gives instant warning of the approach of a dangerous condition.

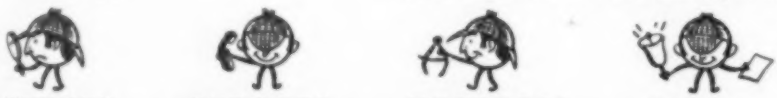
BURNS THERMALO

FLAMMABLE VAPOR DETECTOR

★ Electrical.
★ No glowing filaments.
★ Non-aspirating (in most applications).
★ For fixed installations or portable use.

Write us your problem.

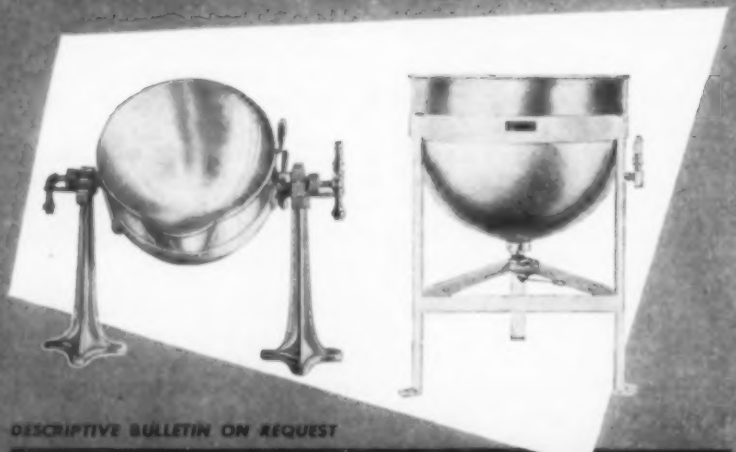
JABEZ BURNS & SONS, INC.
600 W. 43rd Street • New York 18, N. Y.



DETECTS . . . REPORTS . . . MEASURES . . . ACTS!

LEE Kettles

FOR EVERY PROCESSING NEED
Where *Corrosion-Resistant Equipment* is used



DESCRIPTIVE BULLETIN ON REQUEST

LEE Metal Products Company, Inc.
415 PINE STREET . . . . . PHILIPSBURG, PA.

All Lee Kettles are made to A.S.M.E. Code

rejoined Utah Fuel Co., Salt Lake City, as technical assistant to the president.

Russell I. Baker has been appointed plant manager of the general aniline works division of General Aniline & Film Corp., Grasselli, N. J.

Benton H. Wilcoxon, consulting engineer, is now with Calabama Chemical Co. in Huntsville, Ala.

Keator McCubbin has joined the chemical plants division of Blaw-Knox Co., Pittsburgh, Pa., to direct the engineering and sales of plants and equipment for the oils and fats field.

Irving A. Denison has been appointed chief of the underground corrosion section of the National Bureau of Standards. As chief of this section, Dr. Denison will direct fundamental studies of underground corrosion utilizing the data from extended field tests.

Maurice C. Taylor, resident director of research and development of the Mathieson Alkali Works, Niagara Falls, has been elected chairman of the Western New York Section of the American Chemical Society. He succeeds **Wesley Minnis** of the National Aniline Division of the Allied Chemical and Dye Corp., Buffalo.

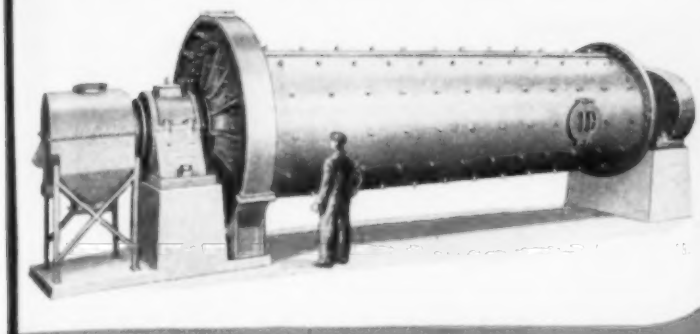
James S. Hollowell has retired as vice president in charge of engineering of the Natural Products Refining Co., Jersey City, N. J. He had been with the company for 30 years. **John Nygren** succeeds him as plant engineer.

William R. Barber, technical director of the Crown Zellerbach Corp., Camas, Wash., has been selected by the executive committee of the Technical Association of the Pulp and Paper industry to fill the office of vice president of the association which became vacant when **W. F. Gillespie** became president following the death of the incumbent **Wothen E. Brawn.**

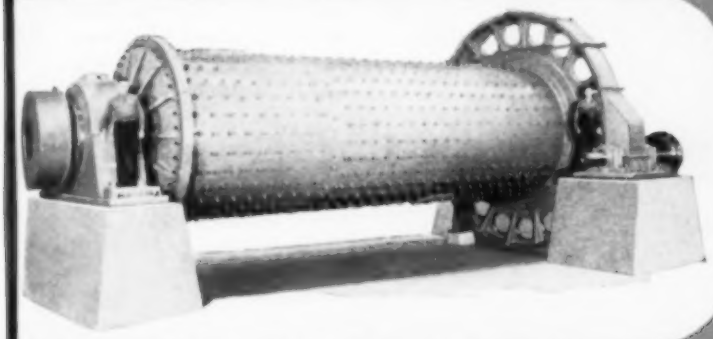
E. S. Blake has been appointed assistant director of research for Monsanto Chemical Co.'s Merrimac Division, Everett, Mass.

Thomas R. Vaughan has been elected assistant vice president of Freeport Sulphur Co., New York.

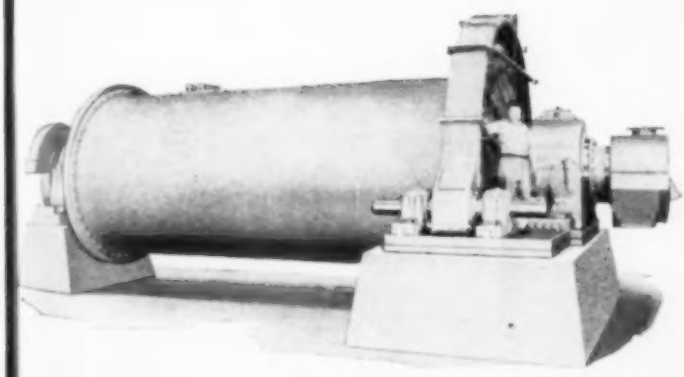
R. L. Bauer and **R. E. Lenz** have been appointed assistant managers of the process section of Monsanto Chemical Co.'s general engineering department. Work of the section will be generally divided along technical and adminis-



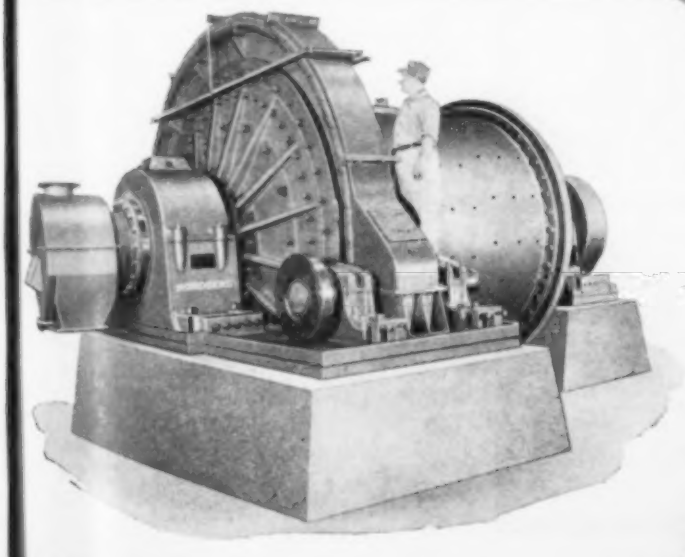
6' x 22' Tube Mill.



9'6" x 32' Two Compartment Mill.



9'6" x 24' Pebble Mill.



9'6" x 11' Ball Mill.

there is a NORDBERG GRINDING MILL for your milling operations

● FOR WET OR DRY GRINDING

● WIDE RANGE OF TYPES AND SIZES

From the extensive line of Nordberg Grinding Mills it is possible to obtain grinding equipment of the high quality design and construction which for more than a half century has characterized heavy machinery built by Nordberg. Ball, Tube, Rod, Pebble and Compartment Mills in various diameters and lengths can be had for dry or wet grinding, for open and closed circuit operation and adaptable to all materials and all product requirements.

If you are building a new plant, expanding your milling operations or replacing obsolete equipment, investigate the merits of the improved Grinding Mills offered by Nordberg.

NORDBERG MFG. CO.
MILWAUKEE 7, WISCONSIN

NEW YORK • SAN FRANCISCO • TORONTO • MEXICO D. F. • LONDON • JOHANNESBURG

NORDBERG MACHINERY

FOR PROCESSING ORES AND MINERALS

CRUSHERS ● GRINDING MILLS ● DIESEL ENGINES
FEEDERS ● VIBRATING SCREENS AND GRIZZLIES
KILNS ● COOLERS ● DRYERS.

Complete *Your* process-picture

with

VIRGINIA

$ZnSO_4$-H_2O

ZINC SULPHATE (Monohydrate)

The many uses of "Virginia" Zinc Sulfate include chemical and pharmaceutical manufacturing, electroplating, glue and adhesives, paint trades, rayon and plastics manufacturing, metallurgical and agricultural applications. It is an exceptionally pure, 89 per cent granular, free-flowing crystal, and is quickly and completely soluble in water . . . zinc content, 36 per cent. Shipped in 100 lb. bags and 400 lb. barrels.

It may well be that "Virginia" Zinc Sulfate can play an important part in perfecting your processes. Our Research Department will be glad to survey your needs for possible applications. Call upon us freely. VIRGINIA SMELTING COMPANY, West Norfolk, Virginia. *Established 1898*

VIRGINIA *Chemicals*

SULFUR DIOXIDE
SODIUM HYDROSULPHITE • ZINC HYDROSULPHITE
ZINC SULFATE

WEST NORFOLK • NEW YORK • BOSTON • DETROIT

trative lines. Mr. Bauer will be primarily responsible for the technical phase and Mr. Lenz the administrative.

Irving H. Welinsky has been appointed research chemist and assigned to general research on the technical staff of the research and development division of Pittsburgh Consolidation Coal Co. **Jack F. Chapin** has been appointed chemical engineer and assigned to operational work on the coal gasification pilot plant. **William E. Lough**, formerly of Morgantown, W. Va., has been appointed chemical engineer and will also be employed on the coal gasification pilot plant.

Harold R. Snow, formerly assistant general superintendent of Pan American Refining Corp. of Texas City, Tex., has become plant manager following the appointment of **P. J. Sweeny**, previous plant manager, as first vice president of the company and of Mexican Petroleum Corp. of Georgia. **B. F. Babin** has been named assistant general superintendent to succeed Snow.

Paul R. Wiley has been appointed director of the development department of West Virginia Pulp and Paper Co. at Charleston, S. C. Dr. Wiley succeeds **Arthur Pollak** who resigned recently after 24 years with the company.

OBITUARIES

George Bell Frankforter, 88, first dean of the school of chemistry at the University of Minnesota, died at his home in Minneapolis last September.

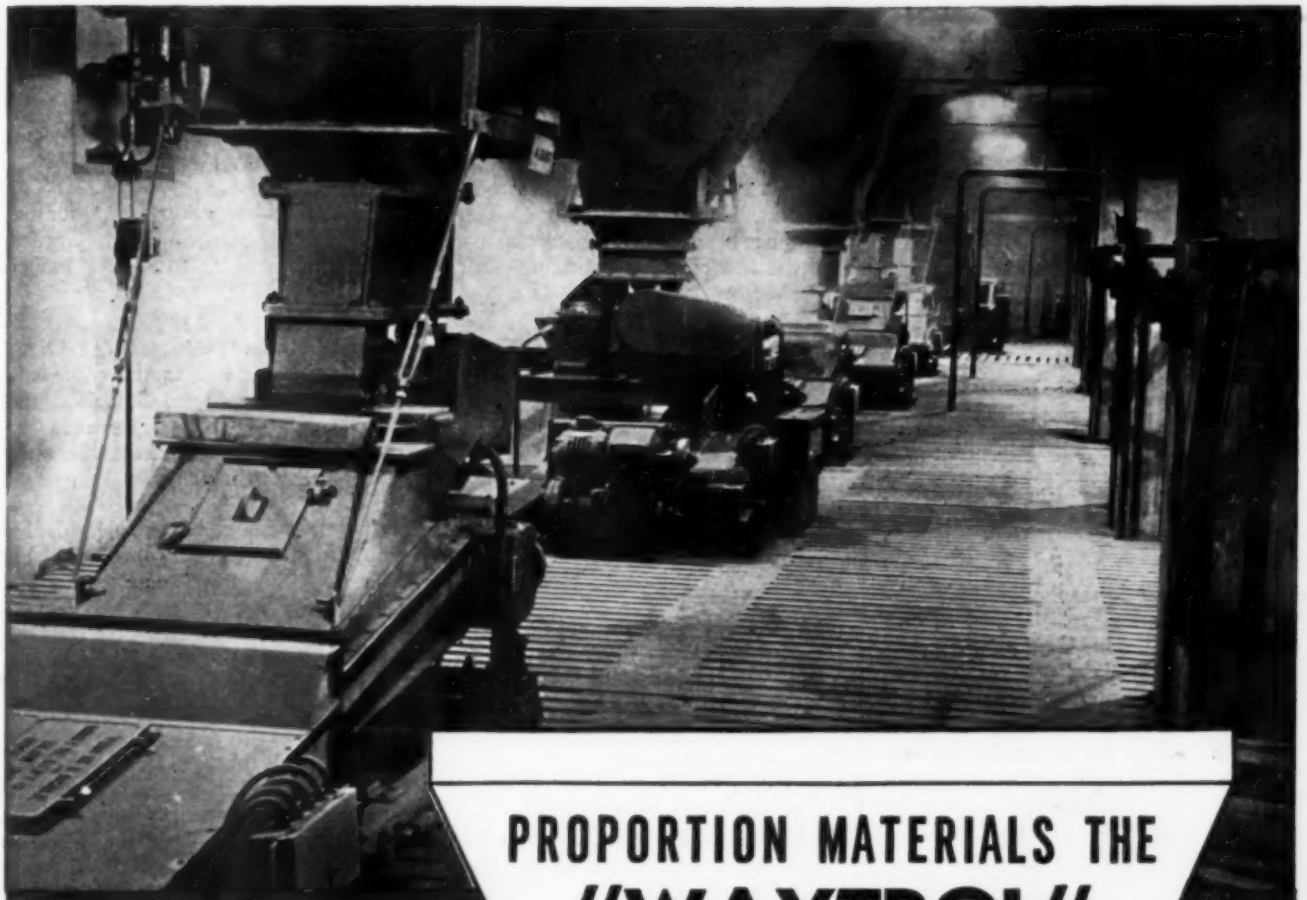
Ole A. Nelson, 55, assistant supervisor of research on metals and chemicals in agriculture at Battelle Memorial Institute, died in Columbus, September 18.

William H. Matthews, 74, authority on wood chemistry and president of the Forest Products Chemical Co., died at Memphis, Tenn., September 28.

Milton F. Merl, 41, engineer with the Republic Flow Meter Co., died in Atlanta, Ga., September 28.

George F. Hardy, 81, senior partner of George F. Hardy & Son, consulting engineers, who for 50 years has been a designer of pulp and paper mills, died in New York October 2.

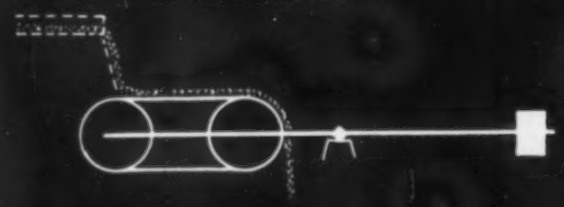
Warren C. Funk, 62, sugar expert with the U. S. Tariff Commission, died at his home in Washington, D. C., October 11.



PROPORTION MATERIALS THE "WAYTROL" WAY

A group of twelve Jeffrey-Traylor Waytrols (Constant Weight Feeders) continuously proportioning six different materials ahead of continuous mixers. Also J-T Electric Vibrating Dryers, Coolers, Feeders, Conveyors, Packers, Screens, and Bin-Level Controls. Let us hear from you.

WEIGHS ACCURATELY



(Patented)

JEFFREY

MANUFACTURING COMPANY

909-99 North Fourth St., Columbus 16, Ohio

ESTABLISHED 1877

Complete Line of Material Handling, Processing and Mining Equipment

A STORY OF TWO ENGINEERS

●

Both have a Packing Problem!

Engineer Jones thought his packing problem was different . . . and knew it when his local packing supplier indicated not one but five separate installations to complete his job. His wry, troubled frown tells us he's looking for a simpler answer.

Engineer Smith knew his ABC's. No wonder he's smiling. One swift glance at his Palmetto Packing Selection chart solved his different packing job in a jiffy. Now he's free to tackle his bigger, more important duties.

●

MORAL: There is not one type of Palmetto Packing for each installation . . . There are only a few types of Palmetto Packings . . . and they cover all applications. Specify Palmetto . . . the Simple, yet Complete line. Write for your Palmetto A-B-C Packing Selection Chart today. It's simple as A-B-C.

PALMETTO Packings

"There is a Palmetto Packing Distributor Near You."

GREENE, TWEED & CO.
NORTH WALES, PENNSYLVANIA

INDUSTRIAL NOTES

General Electric Co., Pittsfield, Mass., has appointed Addison E. Wiles manager of the Pittsfield Molded Products Works. He succeeds Arthur C. Treece who has been named assistant manager of the new plastics laminating plant at Coshocton, Ohio.

Jefferson Chemical Co., Inc., New York, has announced that Nolan B. Sommer has joined the sales department as market development representative.

B. F. Goodrich Co., Akron, has established the plastic materials sales division with L. H. Chenoweth general manager.

Goodyear Tire & Rubber Co., Akron, has appointed Louis W. Rasor district sales manager of the mechanical goods division at Charlotte, N. C. He succeeds Richard G. Abbott, who becomes district manager at Los Angeles.

Monsanto Chemical Co., St. Louis, has made Dr. Reid G. Fordyce sales development manager of the plastics division and Edmund S. Childs assistant manager of the sales development department.

Allis-Chalmers, Milwaukee, has appointed G. Edward Conn, Jr., manager of the new branch office at York, Pa. MacGregor G. Jones will assist him as sales representative.

Nuodex Products Co., Inc., Elizabeth, N. J., has named Robert A. Peterson sales representative in the Chicago district.

Monsanto Chemical Co., St. Louis, has elected Arnold H. Smith, acting managing director of Monsanto (Australia) Pty. Ltd., vice president and member of the board of directors of Monsanto (Canada) Ltd. Irving C. Smith has been promoted to assistant general manager of Monsanto's Western division with headquarters at Seattle, Wash.

Woburn Chemical Corp., Harrison, N. J., has made Ward L. Atwood, assitant to the president, sales manager.

Hewitt-Robins, Inc., Buffalo, has appointed James D. Waser manager of the molded goods sales of the Hewitt Rubber division.

Worthington Pump and Machinery Corp., Harrison, N. J., has appointed Edwin A. Murray and Howard M. Boteler assistant managers of the compressor division at Buffalo, N. Y.

John A. Roebling's Sons Co., Trenton, N. J., has appointed H. S. Christie manager of the Atlanta, Ga., branch office.

Rapids-Standard Co., Inc., Grand Rapids, Mich., has named three new regional sales managers. S. C. T. Lloyd is the southwestern sales manager, John Kramer midwestern, and Plin Mears western manager.

Attapulgus Clay Co., Philadelphia, has moved its executive offices to 210 West Washington Square.

Pennsylvania Salt Mfg. Co., Philadelphia, has added Charles R. Sorber, Jr. and John L. Dawson to the sales staff of the special chemicals division.

Hamilton Rubber Mfg. Corp., Trenton, N. J., has opened a branch office and warehouse at 2017 Preston Ave., Houston, Tex., under the direction of W. A. Olivier.

Chase Bag Co., Chicago, has appointed R. J. Stevens sales manager of the Buffalo branch office.

Atlas Powder Co., Wilmington, has made three promotions. Edward W. Sann to manager of general headquarters in Wilmington, Laurel G. Parkinson to Chicago district manager, and Franklin L. Dailey to the Cleveland area.

Cooper-Bessemer Corp., Mount Vernon, Ohio, has named H. A. Gehres executive vice president and Ralph L. Boyer vice president and chief engineer.

Chas. Pfizer & Co., Inc., New York, has acquired the Citro Chemical Co., a subsidiary of Emerson Drug Co. Charles P. Walker, Jr., president of Citro Chemical Co., and his present staff will continue to operate as a separate unit.

Chemical Products Corp., Cartersville, Ga., has completed construction of its barium plant at Cartersville, and is producing barium sulphide, chloride and carbonate, in addition to sodium and ammonium sulphides and chlorinated benzene.

E. I. du Pont de Nemours & Co., Wilmington, has appointed Thomas J. Desmond sales manager for heavy

CROUSE-HINDS

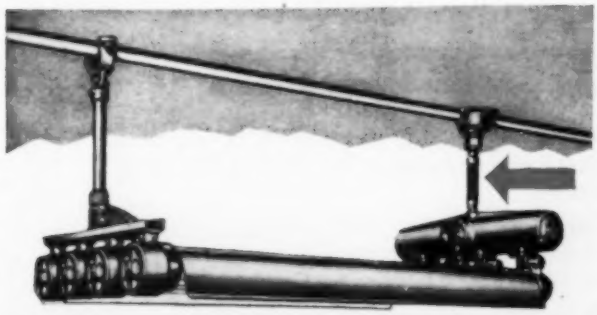
Explosion-Proof and Dust-Tight

Flexible Fixture Supports

provide a neat and economical mounting for lighting fixtures in hazardous locations

They comply with the requirements of Article 500, 1947 National Electrical Code, which specifies a flexible connector in fixture stems over 12 inches long.

1. **Compact streamlined design** .... just slightly larger than the conduit.
2. **Permanently flexible** .... no moving parts.
3. **Self-aligning** .... fixture stem will always be exactly vertical.
4. **Protection** .... flexibility minimizes chance of mechanical injury to the fixture.
5. **Insulating lining** in the flexible part.
6. **Varied nipple arrangements** .... to meet every requirement.
7. **Set screws in all female nipples** .... lock against rotation.
8. **Full range of sizes** .... 4-inch to 18-inch flexible length.



Crouse-Hinds Type EVF Explosion-Proof 4-Lamp Fluorescent Fixture Suspended by ECHF Flexible Fixture Support.

Type ECJF Two Female Nipples

Type ECHF Two Male Nipples

Type ECGF One Female Nipple, One Male Nipple

Type ECKF One Female Union, One Male Nipple

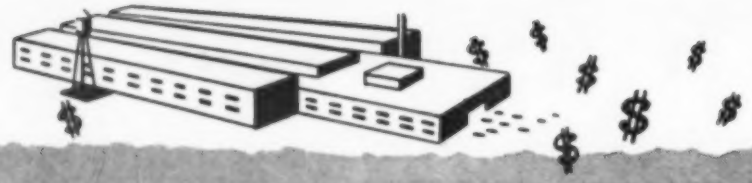
CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

A Nationwide Distribution Through Electrical Wholesalers

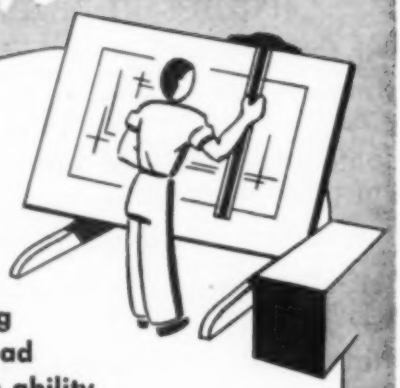
Crouse-Hinds Type EVA Explosion-Proof Fixture Suspended from GUFT Conduiet and GUA Canopy by ECGF Flexible Fixture Support and Conduit Stem

Offices: Birmingham – Boston – Buffalo – Chicago – Cincinnati – Cleveland – Dallas Denver – Detroit – Houston – Indianapolis – Kansas City – Los Angeles Milwaukee – Minneapolis – New York – Philadelphia – Pittsburgh Portland, Ore. – San Francisco – Seattle – St. Louis – Washington.
Resident Representatives: Albany – Atlanta – Charlotte – New Orleans – Richmond, Va.
CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS



YOUR PLANT'S PROFITS
are determined . . .
When the Plans Are Drawn



That's why it's SO important to choose as your design and engineering counsel a firm of broad experience and proven ability.

From drawing board, through construction, to test operation of the completed plant, Pritchard engineers bring to bear upon your problems a thorough familiarity with the latest trends and sound ingenuity in applying new techniques. Also they know and consider in the light of your requirements every commercially significant method from past and present practice that will assure maximum production and profit from your investment.

DESIGN • ENGINEERING • CONSTRUCTION

—one responsibility throughout, or any part of these comprehensive services is available separately.

For more complete information on Pritchard's chemical engineering services see Sweets Files, Chemical Engineering Catalog, Refinery Catalog, etc.

J.F. Pritchard & Co.

ENGINEERS • CONSTRUCTORS • MANUFACTURERS

for the CHEMICAL, PETROLEUM, GAS & POWER industries

CHEMICAL DIVISION • FIDELITY BLDG. • KANSAS CITY 6, MO.

Houston Tulsa Pittsburgh Chicago New York Los Angeles St. Louis

chemicals of the Grasselli Chemicals department, Henry H. Wolf will manage the new sales planning section.

Crocker-Wheeler Electric Mfg. Co., Ampere, N. J., has appointed Paul J. Moore to the new position of director of sales and engineering.

Howell Electric Motors Co., Howell, Mich., has appointed Charles T. Button general sales manager.

Hooker Electrochemical Co., Niagara Falls, has transferred John M. Glaze to the New York sales office.

Philadelphia Quartz Co., Philadelphia, has added Albert C. Pierce to its New York sales staff. Everett W. Turley has been transferred from the New York area to the Chicago office.

B. F. Goodrich Co., Akron, has assigned three men to the Holland rubber plant at Netherlands City. They are: R. J. Hull, factory manager; M. C. Pierce, technical representative in tire construction; and O. J. Dahl, technical representative in compounding.

Paullin Equipment Co., Inc., Buffalo, is the name of a new concern dealing with new and rebuilt mechanical and electrical equipment. Edward M. Paullin is president; John H. Darby, vice president; and Glenn A. Irvin, secretary.

Commercial Solvents Corp., New York, has opened a new district office in the Baronne Bldg., New Orleans. John Owen is manager.

Sharpe & Dohme Inc., Philadelphia, has appointed John G. Bill general sales director.

Chain Belt Co., Milwaukee, has appointed David B. Hill district field engineer in the Atlanta office.

Baker-Raulang Co., Cleveland, has named J. G. Green mid western representative for the Baker Industrial Truck division with headquarters at 407 S. Dearborn St., Chicago.

Merck & Co., Inc., Rahway, N. J., has appointed M. Vincent O'Shea, Jr. administrative vice president.

Goodyear Tire & Rubber Co., Akron, Ohio, has appointed Claude E. Davis field engineer with headquarters in St. Louis.

International Nickel Co., Inc., New York, has moved the Texas technical section to the Commerce Bldg., Houston.

Here's how to balance maintenance against operating dollars

A Select the right type valve for the service.
B Place valves correctly in the line.
C Choose Jenkins Valves for lifetime economy.

Use this simple Jenkins ABC formula to lower maintenance costs—avoid expensive valve replacements—make operating dollars stretch further.

Jenkins Valves are built to stand up *without* nursing or pampering. Choose the *right* Jenkins Valves—place them properly in line—and they will serve *far beyond* normal life expectancy—even under hard and continuous usage in the toughest types of service.

You also get the expert advice of top-flight specialists—Jenkins Engineers—on *any* question of valve selection or placement for *any* service. Base your valve buying on this ABC formula—for the *lowest cost in the long run.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport: Atlanta: Boston: Philadelphia: Chicago: San Francisco. Jenkins Bros., Ltd., Montreal.

LOOK FOR THIS DIAMOND MARK

SINCE 1864

JENKINS VALVES

Types, Sizes, Pressures, Metals for Every Need

Sold Through Reliable Industrial Distributors Everywhere

JENKINS Fig. 651

Renewable Bronze Seat Ring

IRON BODY GATE VALVE

125 lbs. steam
200 lbs. O.W.G.

On this outside screw and yoke valve (flanged) the spindle rises up through the yoke sleeve and serves as an indicator of the wedge position. All pressure-containing parts are "semi-steel" for extra strength. The cast bronze seat ring is removable. Rolled rod bronze spindle. Valve can be repacked under full pressure.

ONE OF OVER 600 EXTRA VALUE VALVES MADE BY JENKINS VALVE SPECIALISTS

For better results

STANLEY
FILTER FABRICS

FILTER FABRICS
ALL KINDS
Cotton, Flax, Wool

VINYON and SARAN
Acid-resistant filter cloths

CLOTHS CUT and FABRICATED
INTO PRESS SACKS
for all purposes
GRAVITY FILTER BAGS

DUST-ARRESTING TUBES
DISCS and VACUUM BAGS
CENTRIFUGE LINERS
in all sizes with fittings

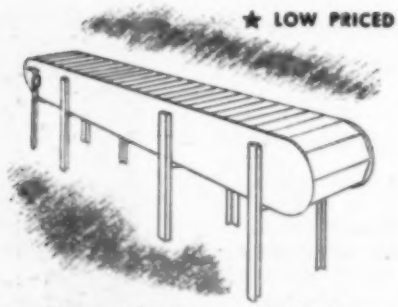
Write for samples and prices
State size and type required

WM. W. STANLEY CO., Inc.
401 Broadway, New York 13, N. Y.

HERE IS PACKAGED
Efficiency and Economy
FOR YOUR PLANT!

MERCURY
CONVEYORS

★ PRE-FABRICATED
★ ALL ALUMINUM ALLOY
★ ACID RESISTING
★ LOW PRICED



Why not let the new all aluminum MERCURY supply the answer to faster, more economical—more efficient production in your plant? Easily handles loads up to 250 lbs. per square foot . . . Available at about one-fifth the cost of stainless steel in widths 6" to 90" *any length!* Shipped pre-fabricated in 5' sections that can be assembled in a jiffy. Immediate delivery!

Write for more particulars.

PATRON TRANSMISSION CO., Inc.
129 Grand St. • New York 13, N. Y.

CONVENTION PAPER ABSTRACTS

CONTENTS

DDT Won't Hurt Livestock.....242
But It May Poison The Butter.....242
Technique Splits Non-Mineral Oils...242
Ultramicroscopy in Color.....244
Low Carbon, 8½% Nickel Steel.....246
Intermingling in Pipelines.....248
Peat Power.....250
Dual Fuel Engine.....250

DDT Won't Hurt Livestock

CORN and peas can be sprayed with DDT at the recommended rates without detrimental effects on livestock fed on the treated crop residues. The chemical is used on peas for aphid control and on corn for borer control. Pea vines and corn plants, when treated in the field with DDT dusts at the recommended rates and concentrations, show appreciable but usually small quantities of DDT in the crop residues.

Silage made from both pea vines and corn showed definite and fairly consistent decreases in their DDT contents during the fermentation and storage processes, prior to the time they would normally be fed. Dairy cows, steers and sheep fed on DDT-treated pea and corn silage showed no symptoms of ill effects of any kind, even when much higher levels of DDT were consumed than will be present on crops treated at recommended rates. The milk from two groups of dairy cows fed on treated pea silage and treated corn silage, respectively, consistently showed levels of DDT in the milk which are so low that they appear to be insignificant.

Henry A. Lardy, University of Wisconsin, before Division of Agricultural and Food Chemistry, American Chemical Society, New York, Sept. 17, 1947.

But It May Poison The Butter

BUTTER made from the milk of cows which have eaten forage treated with DDT may be a menace to human health. The cows transmit the insecticides to their milk. The DDT is concentrated in the butter-fat portion of the milk, so that a relatively small amount in the whole milk could possibly result in an injurious amount in the butter. The general availability and effectiveness of DDT as an insecticide introduces the possibility of its widespread occurrence on and in food products for man and on forage crops for animals. The most serious source of danger from the use of DDT is the repeated ingestion of small amounts that cling to forage, fruits and vegetables that have been treated with this insecticide.

DDT has certain unique characteristics as a poison. First, ingested DDT accumulates in the tissues, especially in the fatty tissues, of animals. Since such staple foods as milk, butter, meat, lard, and eggs are used in enormous quantities, the presence of small amounts of DDT in animal food assumes the same importance as relatively larger amounts on fruits and vegetables consumed directly by man.

Second, there are wide individual variations within a given animal species in susceptibility to poisoning. This individual susceptibility has been observed in all animal species and, therefore, probably would be true for man.

The level of DDT intake which shows liver damage is much below that which shows significant gross effects such as retardation of growth and hyperexcitability. Small continued dosages, such as 10 parts per million in the diet, show slight damage to the liver of animals.

O. G. Fitzhugh, Food and Drug Administration, before Division of Agricultural and Food Chemistry, American Chemical Society, New York, Sept. 17, 1947.

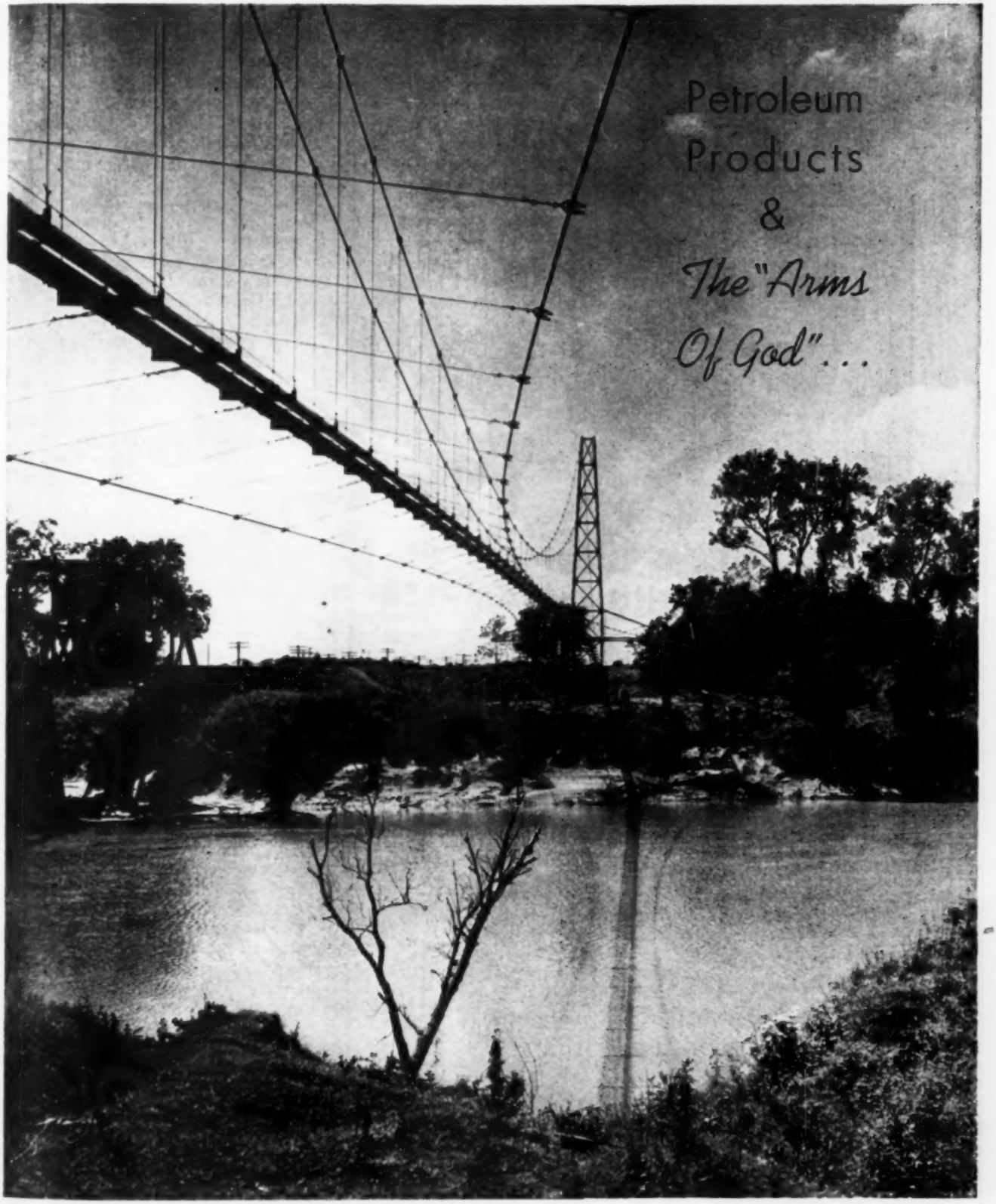
New Technique Splits Non-Mineral Oils

VALUABLE raw materials for the food and paint industries are being provided through a recently developed technique for splitting natural vegetable and animal oils.

Soybean oil has been divided into two fractions, one a fast drying oil and the other a greatly improved food oil well adapted to the manufacture of shortenings. Soybean oil ordinarily is neither a good drying oil nor a particularly good food oil. Moreover, minor changes in the process will permit recovery of a byproduct that is rich in vitamin E and other valuable materials.

The process is essentially a continuous distillation, aided by a solvent, furfural. The process is similarly adapted to the fractionation of many other natural vegetable and animal oils. A new tool has thus been found for the separation of natural mixtures of chemically similar products hitherto inseparable by practical means. It should find many new applications during the next few years.

A commercial plant was operated

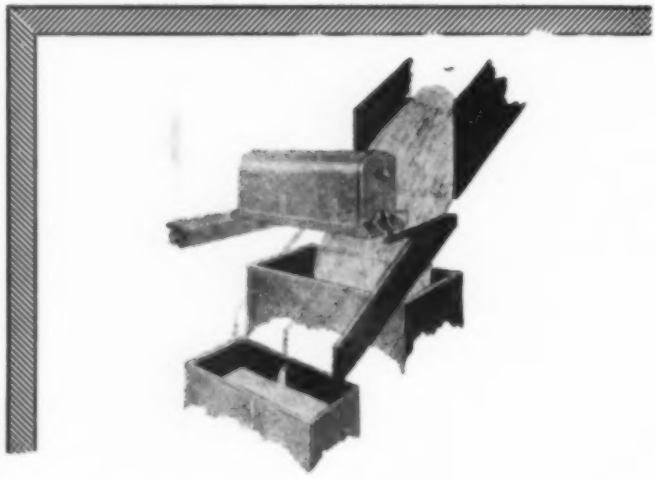


Legend says Spaniards fleeing Indians in Texas long ago were saved when a sudden flood in a stream they had just crossed stopped the savages. Thankfully, they named the protecting river the "Arms of God," in Spanish, "Brazos del Dios," now shortened to Brazos. Modern Brazos floods seem heedless of whose path they block, but flow of petroleum products in the 8-inch line above will never the interrupted. Brown & Root, Inc. have bridged the Brazos near Sealy with a 625-foot (between towers) pipe line crossing of their design, fabrication and erection. Take your river problems to Brown & Root, Inc.

BROWN & ROOT, INC.

P. O. Box 2634, Houston, Texas

Here's The Right Angle On Accurate Sampling



THE GEARY-JENNINGS SAMPLER

is the only automatic sampler protected by patents which operates by taking a sample at right angles to the stream.

The Geary-Jennings Sampler travels in a straight line and at right angles to the stream of material being sampled, at a uniform rate, crossing at constant intervals. Thus it takes uniform samples from all parts of the stream and eliminates errors due to change in character of the stream across its section. This is the unique principle of operation that has established Geary-Jennings in its place of leadership in the metals and chemical process industries.

For full description of this unique principle of sampling—write today for Bulletin 451.

"Leaders in Experience and Service"

THE GALIGHER CO.

Home Office
545 West 8th South St.
SALT LAKE CITY 1, UTAH

Eastern Office
921 BERGEN AVENUE
JERSEY CITY 6, N. J.

throughout World War II fractionating linseed oil. The extract fraction was a highly unsaturated oil closely resembling perilla oil. It entered into the manufacture of fast drying varnishes and went far toward relieving the war-born shortages of China wood and other hard drying oils.

The process is dependent on the use of selective solvents with which the oils are not completely miscible at operating temperatures. Thus, when a glyceride oil and a selective solvent, such as furfural, are brought together at a temperature lower than that of complete miscibility, two fractions are obtained.

One of the fractions consists predominantly of the solvent, while the other is chiefly oil. The solvent fraction contains most of the fast drying oil prized by the paint industry. The less active oils used in the food industry remain in the oil fraction. Continuous distillation is used to separate the two fractions.

Although many solvents are selective, the most practical and the one used commercially is furfural, six to fourteen parts of which are added to one part of the original oil. The ratio and temperature of the solvent are essential factors in determining the yield and quality of products.

S. W. Gloyer, Pittsburgh Plate Glass Co., before Division of Industrial and Engineering Chemistry, American Chemical Society, New York, Sept. 17, 1947.

Ultramicroscopy in Color

More durable plastics and more elastic rubber are promised by a new microscopic technique utilizing color photographs. With an ultramicroscope scientists can inspect enlarged and sharply defined reflections of tiny particles of rubber, soap, plastics, and other materials too small to be visible under an ordinary microscope. Color film, because of its extremely fine grain, is ideally suited to photographing what the ultramicroscope reveals.

Although greater magnification is possible with the electron microscope, the penetrating stream of high-speed electrons tends to "burn" and destroy the delicate fibers under observation.

The new photo-ultramicroscopic technique has already been successfully applied to studies of natural and synthetic rubbers and several plastics. It has offered the first visual proof that the results obtained with the electron microscope were misleading insofar as they did not permit ascertaining the influence that time and temperature have on the structure of the substance under observation.

To obtain the best results, the material to be studied is deposited on a fine wire mesh, with 200 to 300 open-

Hooker Cyclohexanol and Methyl Cyclohexanol

Solvents
Plasticizers
Homogenizing Agents
FOR
Lacquers
Coatings
Resins

Hooker high pressure autoclaves in which hydrogenations are carried out receive periodic inspection and careful maintenance.

HERE ARE TWO SPECIAL PRODUCTS worthy of investigation in your compounding and application of resins and plastics.

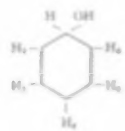
Cyclohexanol and Methyl Cyclohexanol have excellent solvent and plasticizing properties for many natural and synthetic resins. Cyclohexanol is particularly well adapted as a solvent for various oils, gums and waxes used in lacquer manufacture. It blends well with more volatile solvents and has excellent homogenizing ability. It is also compatible with a variety of resins which may be used in coating composition.

Methyl Cyclohexanol is an excellent solvent for waxes and resins, particularly the cellulose esters and ethers. Its low volatility and good emulsifying properties indicate a wide usefulness in the coating composition field.

Principal physical characteristics are listed below. Additional information is contained in Hooker Technical data sheets. When writing for more information please use your business letterhead.

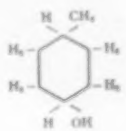
PHYSICAL DATA

Cyclohexanol
$C_6H_{11}OH$



Mol. Wt.	100.1
Sp. Gr., 25°/15.5°C	0.945
R. I., n20/D	1.4654
Flash Point	68°C
F. R. High Grade	18° to 22°C
Tech Grade	0° to 5°C
B. R. High Grade (100%)	159° to 163°C
Tech Grade (95%)	155° to 165°C

Methyl Cyclohexanol
$CH_3CH_{10}OH$



Mol. Wt.	114.1
Sp. Gr., 15.5°/15.5°	0.924
R. I., n20/D	1.461
Flash and Fire Points	71°C
F. R.	about 20°C
B. R. (100%)	155° to 180°C

HOOKER ELECTROCHEMICAL COMPANY

5 Forty-Seventh St., Niagara Falls, N. Y.
New York, N. Y. Wilmington, Calif. Tacoma, Wash.

HOOKER CHEMICALS

Caustic Soda Paradichlorbenzene Muriatic Acid Chlorine Sodium Sulfide Sodium Sulfhydrate

Look at the Record

ADVANTAGES OF DIXIE'S PATENTED CRUSHING PRINCIPLE CONCLUSIVELY DEMONSTRATED IN THE CEMENT INDUSTRY

10 MEN SAVED!

Many a cement plant has whipped a bottleneck, stepped up production and reduced costs after installing a Dixie patented Non-Clog Hammermill. One cement plant*, for instance, found that it could handle even the wettest, stickiest material direct from the quarry witnout slowing down production or clogging the feed. The necessity for extra men at the feed hopper was eliminated . . . the time of *ten men saved!* *name on request

HIGH MOISTURE CONTENT *won't stop a* DIXIE

Semi-tropical rainfall combined with naturally soft material encountered in quarrying operations was seriously curtailing production in the plant of a well known cement manufacturer*. It was not until a Dixie Non-Clog Hammermill was put to work here that delays due to "choke ups" were reduced and a new high in production was established. Operating at times for a whole week on raw material which was "nothing but a mass of plastic, sticky water-sodden mud"...this Dixie Hammermill has been instrumental in keeping production at a high peak...yet at low cost. *name on request

The above are but two examples of the production miracles frequently experienced by cement plants using Dixie Hammermills. Wherever Dixies are installed costs go down, output goes up, shutdowns are minimized. If you have difficulty reaching and maintaining desired production, *if you have any crushing problem at all,* it will pay you to apply this improved crushing principle to your needs.

WRITE TODAY FOR FULL INFORMATION AND CATALOGS

DIXIE

MACHINERY MANUFACTURING CO.

4172 Goodfellow Ave. St. Louis 20, Mo.

Foreign Sales Office: 104 Pearl St. New York, N. Y.

ings per inch. In addition, the photographic equipment must be of such construction that it permits continuous observation of the preparation and the makings of exposures, just as if ordinary snapshots were being taken.

E. A. Hauser, Massachusetts Institute of Technology, before Northeastern Section, American Chemical Society, Cambridge, Mass., Oct. 10, 1947.

Properties of Low Carbon, 8½ Percent Nickel Steel

INCREASING use of low temperature processing, and the advantages associated with storage of gases in liquefied form, has stimulated interest in finding a moderately priced material of construction that is resistant to the embrittling effects of low temperature and which can be fabricated under somewhat the same conditions associated with structural steel.

Any material considered must not only be readily weldable by accepted commercial methods but must also meet the mechanical property requirements after welding. If the requirements can be met in the as-welded condition, the material has an added advantage, although a simple stress relief anneal or comparable thermal treatment is not prohibitive.

In searching for a ferritic steel that would meet the conditions it was decided to extend existing knowledge of the effect of nickel on low temper notch toughness of steel by increasing the nickel content to 5 percent and testing at temperatures below −200 deg. F. Test results led to stimulation of interest in the effect of larger nickel additions and led to study of low carbon steels containing nickel in excess of 5 percent.

Melts were made in which nickel was increased progressively from 6 percent to 13 percent, and tested at room temperature and at temperatures down to that of liquid nitrogen, −320 deg. F. There was a rapid improvement in impact resistance at −320 when the nickel content approached 8.0 percent. Further study was limited to compositions containing nominally 8½ percent nickel, as this level was considered the most economical on the basis of alloy cost, and was sufficiently high to compensate for variables in composition and processing.

Development of low carbon 8½ percent nickel steel was primarily for low temperature service, but it is surprising to find that the product is being considered for many fields of use in which low temperatures are not a factor. It should not be considered as a substitute for the austenitic chromium-nickel stainless steels, although it may be suitable for application involving a particular type of corrosion; neither is

1-development

Over a half century of recognition in the design and development of approved systems for fire protection . . .

"Automatic" Sprinkler leads in this department.

2-manufacture

Devices manufactured to the utmost degree of accuracy . . . all systems built to order in modern, centrally located fabrication plants . . .

"Automatic" Sprinkler leads in this department.

3-engineering

District Sales-Engineering Offices in over 40 leading cities in the Western Hemisphere assure speedy, efficient attention to your varied fire protection problems . . .

"Automatic" Sprinkler leads in this department.

4-installation

Hundreds of responsible sprinkler mechanics supervised by foremen skilled in the science of sprinkler installations for every type of occupancy.

"Automatic" Sprinkler leads in this department.

5-maintenance

Trained inspectors making periodic examinations of completed installations assure maximum sprinkler system efficiency at all times and effective operation of equipment whenever an emergency arises . . .

"Automatic" Sprinkler leads in this department.

Then there's "Automatic" Sprinkler's advantages from an investment point of view — but why not let your nearest "Automatic" Sprinkler representative acquaint you with the details? "Automatic" Sprinkler Corporation of America, Youngstown 1, Ohio.

"Automatic" Sprinkler devices and systems are listed by Underwriters' Laboratories, Inc., and approved by Factory Mutual Laboratories.

FIRE PROTECTION

DEVELOPMENT ENGINEERING

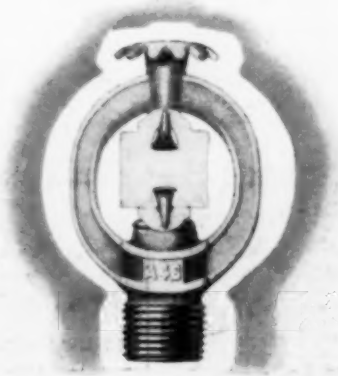
Automatic Sprinkler

MANUFACTURE INSTALLATION

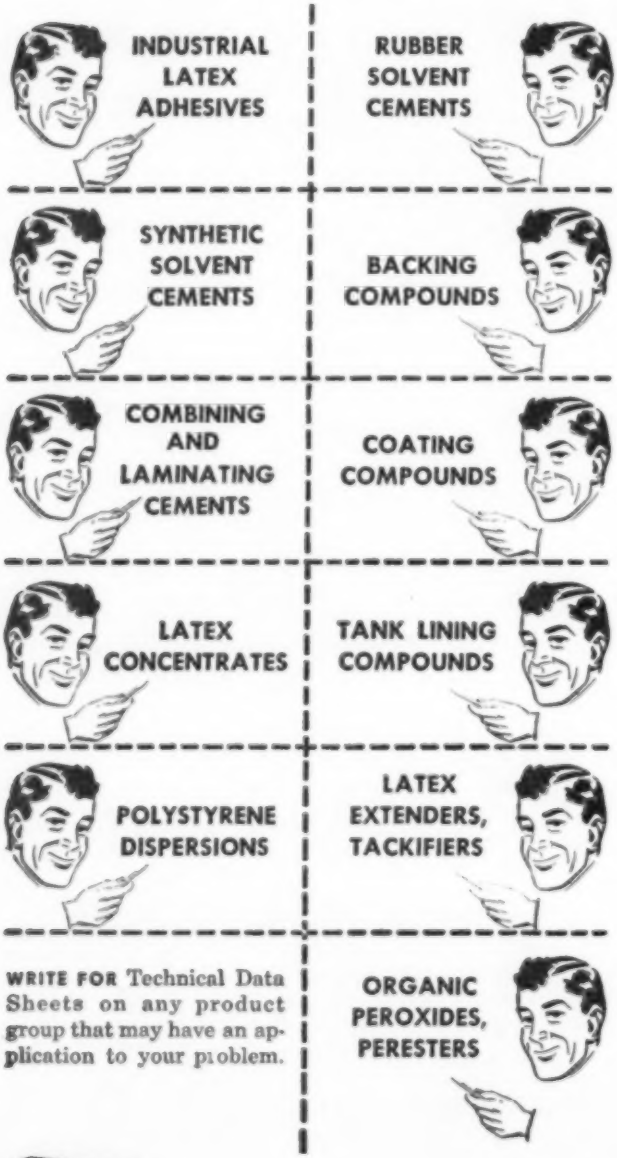
"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA

YOUNGSTOWN 1, OHIO

OFFICES IN PRINCIPAL CITIES OF NORTH and SOUTH AMERICA



Serving Industry with Creative Chemistry



UNION BAY STATE
Chemical Company Inc.
50 HARVARD STREET, CAMBRIDGE 42, MASS.

it suggested as a replacement for the low alloy steels for applications in which high strength is the primary consideration. In certain respects this new nickel steel does have an attractive combination of properties which, together with its moderate price, will ultimately determine its proper position as an engineering material.

T. N. Armstrong and G. R. Brophy, International Nickel Co., before 1947 National Conference on Petroleum Mechanical Engineering, American Society of Mechanical Engineers, Houston, Tex., Oct. 5-8, 1947.

Factors Affecting Intermingling in Pipelines

This discussion briefly summarizes methods used to minimize and control co-mingling, or intermixing, of adjacent products during pipeline shipment. Any system of control is a special problem due to differences in length of line, design, equipment and type of product handled.

Three classes of products receiving particular attention, called "special products," are (1) kerosene, burning oils and distillates, (2) butane, (3) aviation gasolines. The first step in controlling co-mingling of a special product consists of proper sampling and testing before the product is accepted for shipment, with close attention given to specifications most susceptible to effects of co-mingling. Attention is also given to the products which will precede and follow a special product in order to minimize co-mingling. Co-mingling is reduced during handling from tankage to the pump suction of the initial station by use of separate suction lines, line draining and washing, blinding off connections when necessary, or a combination of these. If periodical sampling of the special product at the pump suction of the station initiating the shipment indicates that co-mingling is continuing after the leading portion of the slug has been received, immediate effort is made to determine and correct the cause.

Tests indicate that the length of the intermixed or co-mingled portion between successive slugs tends to increase but little with continuing line travel. Tests also indicate that after the initial station, the length of the co-mingled portion is proportional to the number of stations through which products are handled. The source of this increase in the volume of co-mingling during station handling is the "dead fluid" in station bypasses and equipment.

The leading portion of the slug of a special product is used to displace or wash the dead fluid from station bypasses and equipment. Thus the effect of co-mingling is principally contained

Which of these "personalities" will solve your high temperature problem?

TIMKEN CARBON STEEL TUBES Generally for service not exceeding 900°F., where corrosion and oxidation resistance are not important.

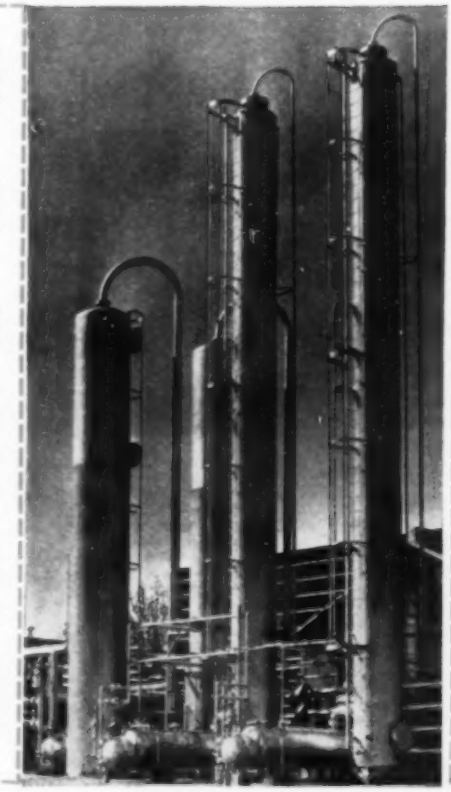
TIMKEN CARBON-MO STEEL TUBES For temperature up to 1000°F. Improved creep strength makes it safer than carbon steel.

TIMKEN D M STEEL TUBES For service up to 1150°F. This steel offers outstanding creep strength.

TIMKEN 2% CR ½% MO STEEL TUBES For service up to 1150°F. Intermediate corrosion resistance plus good creep strength, fair oxidation resistance.

TIMKEN SICROMO 2 STEEL TUBES For service up to 1200°F., where better scale resistance is required than can be obtained with 2% Cr. ½% Mo. Steel.

TIMKEN 2¼% CR-1.0% MO STEEL TUBES For service up to 1150°F. Has greater resistance to creep than 2% Cr. ½% Mo. Steel.



TIMKEN SICROMO 3 STEEL TUBES For service up to 1200°F. Have excellent oxidation resistance and good corrosion resistance.

TIMKEN 4-6% CR MO STEEL TUBES For service up to 1200°F. Superior corrosion resistance. Less oxidation resistance than Sicromo 3.

TIMKEN SICROMO 5 S STEEL TUBES For oxidation resistance to 1500°F. Good creep strength and corrosion resistance to 1300°F.

TIMKEN SICROMO 7 STEEL TUBES For applications requiring better corrosion resistance than can be obtained with 5% Chromium type steels.

TIMKEN SICROMO 9 M STEEL TUBES This steel possesses the maximum corrosion resistance of any of the steels below the stainless group.

TIMKEN 18-8 STEEL TUBES Shows the best combination of creep strength, oil corrosion resistance and oxidation resistance up to 1500°F.

MAYBE corrosion is your toughest high temperature tube problem. Or is it heat, pressure or oxidation? Whatever it is, you'll find the solution in one of the Timken high temperature tubes listed above.

Each one of these 12 Timken steels has its own tough "personality"—a combination of physical properties which makes it the *best* analysis for specific operating conditions.

Which one will best meet *your* needs? It takes a specialist to answer that question—to help you select the analysis that will give you maximum tube life per dollar invested. That's why it will pay you to consult The Timken Roller Bearing Company's technical staff—recognized authority on high temperature applications.

Once selected, our complete quality control assures uniform quality of your analysis from shipment to shipment. So to get maximum service life for your tube dollars, take your problems to Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing

3 STEPS TO PROFITS for CHEMICAL PROCESSING PLANTS

Automatic proportioner . . . for two or more liquids . . . with patented, precision volumetric meter control. Records quantity of each ingredient as well as finished product. Eliminates costly batch mixing . . . reduces labor, handling costs, storage space and capital investment.
Automatic unit for filling containers in predetermined quantities from one pint to nine quarts. Temperature control and specific gravity adjustment.
Bowser Industrial Xacto Meters accurately measure liquids ranging from acids to wood oil. Gray cast iron, brass and bronze or stainless steel construction.
BOWSER
SINCE 1885

. . . SHORT-CUTS TO OPERATING ECONOMY

These Bowser units have led the way to lower processing costs in many plants by eliminating shortages, streamlining production and guaranteeing uniformity of product.

A Bowser man will be glad to check your requirements and make recommendations.
No obligation . . . just write BOWSER, INC.,
1367 Creighton Avenue, Fort Wayne 2, Indiana

Liquid Control Specialists Since 1885

in the leading portion of the slug. This procedure eliminates the possibility of slow displacement of the dead fluid and its absorption by a considerable length of the slug of special product.

D. A. Roach, Phillips Petroleum Co., before 1947 National Conference on Petroleum Mechanical Engineering of the American Society of Mechanical Engineers, Houston, Tex., Oct. 5-8, 1947.

Peat Power

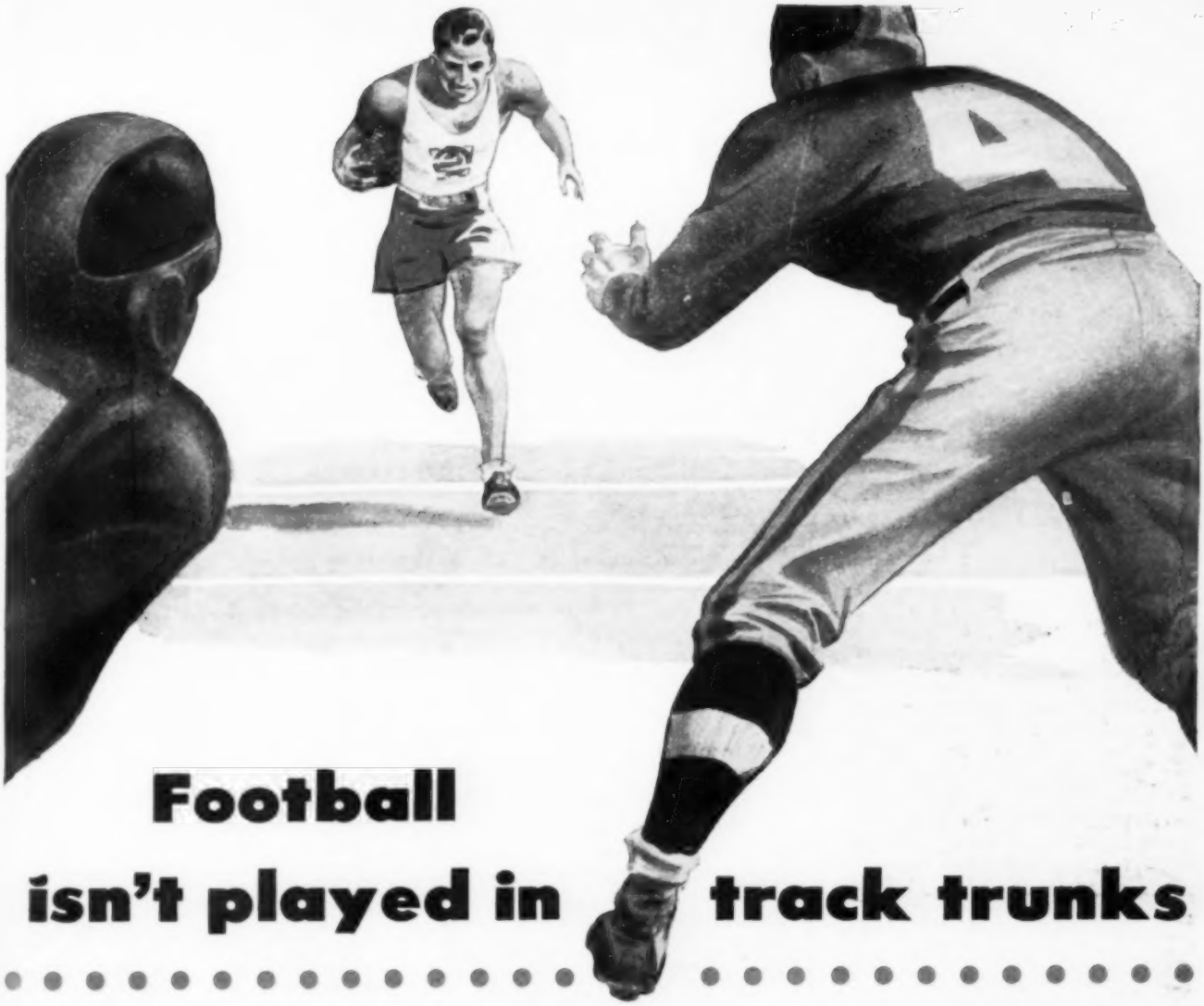
DISCOVERY that Russia is processing from 50 to 60 million tons of bog peat into gas and power to serve industrial needs has quickened America's 60-year-old but relatively dormant efforts to utilize the country's nearly 14 billion tons of this low-grade fuel.

While detailed information on the Russian operations is far from complete, some important facts about their use of peat seem to be reliably established. They have eliminated the inherently high peat transportation costs by converting the peat into electric power and fuel gas at the site of the bog and transmitting the end products to the points of consumption. They are operating power stations up to 200,000 kw. capacity exclusively on peat fuel. They consider their peat bogs as large reservoirs of a wide variety of chemical products, and they keep a staff of 300 research scientists studying methods for recovering the chemicals on a commercial scale. To date, the experiments have demonstrated that peat containing 85 percent moisture can be easily formed into pellets the size of which can be controlled. The smaller sizes dry quite rapidly and the dried pellets are hard and will not fracture when subjected to rough handling.

Robert L. Fitzgerald, Duluth Steam Corp., before the annual convention of the American Society of Civil Engineers, Duluth, Minn., July 17, 1947.

Dual Fuel Engine

THE PROBLEM of obtaining fuel economy at light load as well as full load, which has retarded the use of the gas-diesel engine in power plants, has been solved. The gas-diesel engine or the dual-fuel engine as it is sometimes called is an engine that will operate by means of gas or oil, or both, as fuel, and which can be instantaneously converted from one fuel to the other at any time. Where natural gas is available, it is frequently much more economical to use than fuel oil. However, too many industrial concerns have experienced gas shortages in cold weather to place complete confidence in the reliability of that fuel. Even if it would be necessary to spend a few hours converting the engine, the gas-diesel is very attractive since there



Football isn't played in track trunks

Clad in track suit, what chance would a player have against a team equipped with the "armored" togs of football!

In many phases of production involving paper . . . essential industrial papers, that is . . . it also becomes vital to provide proper physical and chemical characteristics to withstand "unnecessary roughing". Modern MOSINEE papers for the plastics industry, for instance, are engineered specifically for plastics requirements. For the electrical industry and other mechanical applications, MOSINEE paper characteristics are provided for maximum arc resistance, high dielectric strength, low moisture absorption, high strength-weight ratio. For other products and processes, MOSINEE creates special stretching papers, high tensile, high fold and tear resistance, high absorption or moisture repellency papers . . . controlled maximum-minimum pH, and other scientifically created papers . . . dependable in uniformity and performance.

MOSINEE paper technicians are prepared to equip the paper you need with characteristics that improve product and production. Call MOSINEE.

MOSINEE PAPER MILLS COMPANY

MOSINEE • WISCONSIN

Essential Paper Makers

Please address your letter Attention Dept. C"

Since 1925

HILCO EQUIPMENT
has been purifying a wide variety of lubricating, fuel, and industrial oils

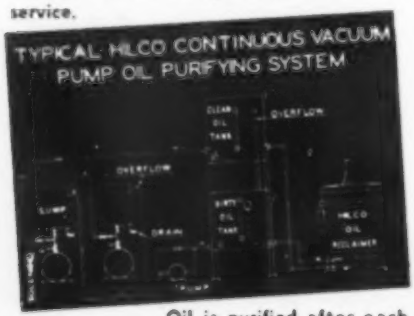
EQUIPMENT SERVICED BY HILCO in the Chemical Industry includes:

★ VACUUM PUMPS—lubricating and sealing oil maintained free from grit, sludge, acid, moisture and dissolved gases.

★ COMPRESSORS – kept free from carbon and varnish deposits.

★ DIESEL ENGINES – lube oil constantly kept in condition of new oil, greatly extending engine life; fuel oil filtered, promoting combustion efficiency.

★ TRANSFORMERS – insulating oil fully desludged, neutralized, dehydrated and deaerated without taking transformers out of service.



Oil is purified after each pass through pump.

★

THE HILCO OIL RECLAIMER is a miniature refinery which by continuous operation removes oil contaminants from a lube system as fast as they are formed or introduced, thus maintaining the oil at new oil specifications.

★

PROTECT YOUR INVESTMENT in process equipment by keeping the lubricating systems clean. HILCO equipment is available to take care of all types of oil purifying problems.

THE HILLIARD CORPORATION
131 W. Fourth St., ELMIRA, N. Y.

WRITE TO-DAY! FOR FREE INFORMATION

THE HILLIARD Corporation
ELMIRA. N. Y.

PLEASE SEND YOUR BULLETIN NO. 95

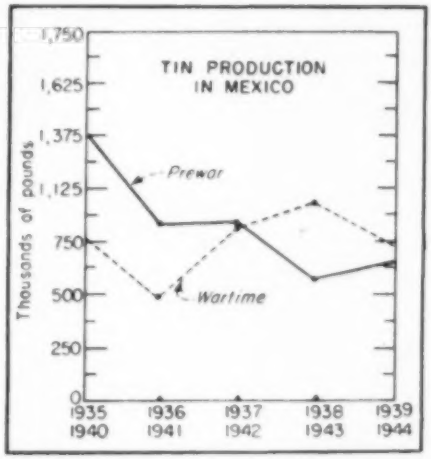
NAME_____
COMPANY_____
STREET_____
CITY_____ STATE_____

is usually considerable warning when there is going to be a gas shortage and it would, in that case, be possible for the user to convert back to oil for several weeks, if necessary, during cold weather.

Gordon Lefebvre, Cooper-Bessemer Corp., before the American Power Association, Cleveland, Ohio, May 22, 1947.

FOREIGN LITERATURE ABSTRACTS

Mexican Production of Tin



MEXICO produced almost one million pounds of tin in 1943, one of the most critical years of the war. From 1940 through 1944 Mexico produced 3,761,500 lb. of tin, which makes an annual average production of 752,300 lb. The attached graph shows Mexico's prewar and wartime production of tin. It is difficult to predict the future of this country's output. Transportation facilities are poor, but the present program for highway construction should be of great help in this respect. The chief tin producers of the republic are Durango, Guajato, Jalisco, Aguascalientes, San Luis Potosi, Zacatecas, Hidalgo, Puebla and Queretaro. The tin is mined by small companies and individuals who own small mines. In general, the Compañia Estanera Mexicana of San Luis Potosi buys all the tin produced by the small companies and individuals. It is smelted in foundries located in San Luis Potosi and the refined metal exported in the form of ingots. The chief consumers of Mexican tin before the war were England, the Netherlands, Belgium, United States and Germany. During the war, the sole consumers were United States and Cuba. Almost 95 percent of the tin produced is export-

INCREASED PRODUCTION

with Paul O. Abbé equipment results from better mechanical design, 68 years of exclusive concentration on grinding and mixing problems, and expert engineering service.

PAUL O. ABBÉ

CENTER AVE., LITTLE FALLS, NEW JERSEY

The typical machines shown are Rotary Cutter, Ball and Pebble Mill, Jar Mill and Mixer.

If you designed your own boiler—you would be sure it had Plenty of Guts!

Water Tube Design

Inclined Tubes

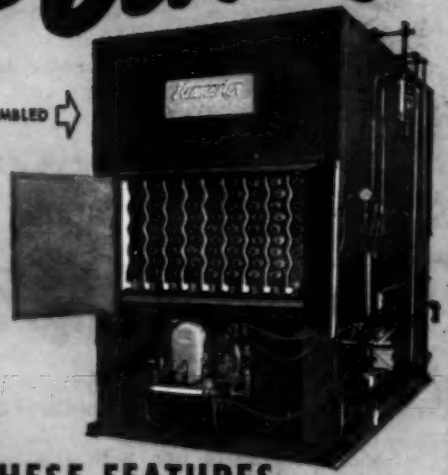
Sectional Steel Headers

Longitudinal Drum

The GUTS of the Steamaster Boiler

Steamaster Builds Boilers with PLENTY OF GUTS!

COMPLETELY SHOP ASSEMBLED



CHECK the features you would include if you designed your own boiler

- ☐ Water Tube Design.
- ☐ Inclined Tubes.
- ☐ Sectional Steel Headers.
- ☐ Longitudinal Drum.
- ☐ All Steel Construction.
- ☐ Positive Tidal Circulation of Water—maintains all parts at equal temperature.
- ☐ Condensate Return System built-in as an integral part of all boilers of 60 h.p. and up.
- ☐ Easy Inspection and Maintenance—every tube immediately accessible. Just open the heavily insulated access doors.
- ☐ Large Combustion Area—Three-pass heat baffling gives high thermal efficiency.
- ☐ Choice of Fuel—gas, oil or coal or any combination of these fuels to meet fuel requirements of your plant.
- ☐ Fully Equipped for Automatic Operation—with the finest accessories. As nearly automatic as a boiler can be.
- ☐ A.S.M.E. CODE—National Board Approved. Inspected and certified by Hartford Steam Boiler Inspection and Insurance Co.
- ☐ Full Range of Sizes from 10 h.p. to 300 h.p. as illustrated. The Model A for 3½ h.p., 5 h.p. and 7½ h.p.
- ☐ Can Be Fired Over Rated Capacity and still maintain high thermal efficiency.

THESE FEATURES..... are built in all steamaster Boilers from 10 horsepower to 300 horsepower.

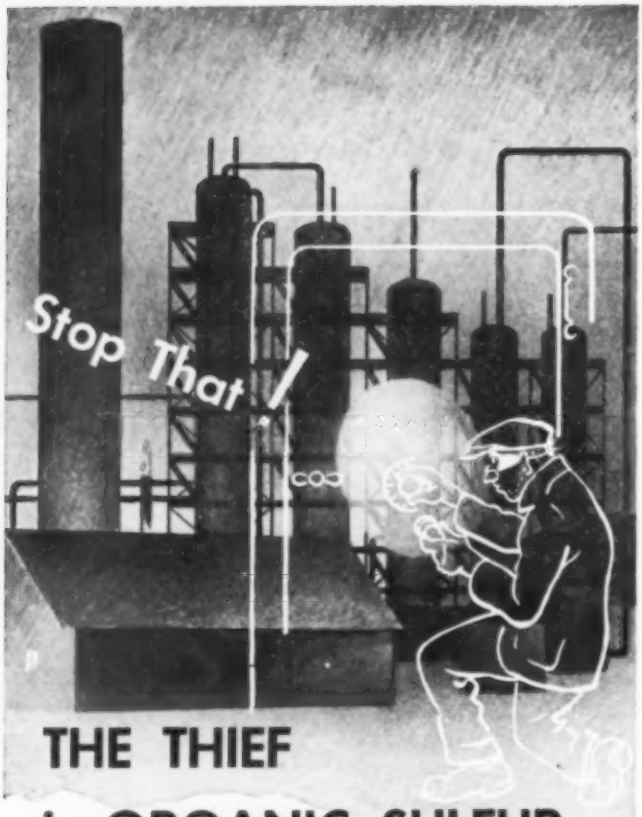
Steamaster

AUTOMATIC BOILER CO.

5819 South Compton Ave. Los Angeles 11

SALES AND SERVICE IN ALL PRINCIPAL CITIES

Power Engineers Agree: STEAMASTER is the Boiler with PLENTY OF GUTS!



THE THIEF
is ORGANIC SULFUR

Catalytic removal of objectionable sulfur compounds has been found to work great improvement in the leaded octane numbers of most gasolines. At the same time, "sour" distillates are "sweetened."

FLOREX* and Florite*

are inexpensive natural catalysts which modern refiners use with the most satisfactory results in their desulfurization processes. Samples and technical data are available on request. Inquiries are welcomed.

*Trademark Registered

FLORIDIN COMPANY, INC.
ADSORBENTS

Department A, 220 Liberty Street Warren, Pa.

ed, but domestic consumption should increase if industrial progress continues as expected in Mexico.

Digest from "Mexican Victory Minerals" by Eugenio Ysita, *Industria Minera* VI, No. 66, 48-53, 1947. (Published in Argentina.)

Analysis of Hydrocarbon Mixtures

A NEW method of analysis of binary mixtures of isomeric paraffins has been developed from the work of Dice and Hildebrand on the solubility of stannic iodide in paraffins. This work showed that the internal pressure of normal hydrocarbons increases with increased molecular weight and is greater than that for branched-chain hydrocarbons. The true order of the internal pressures of hydrocarbons is represented by the critical temperatures of solution of tin tetraiodide in the hydrocarbons. It was found that this critical solution temperature of stannic iodide in hydrocarbons depends not only upon the concentration but also upon the structure and molecular weight of the hydrocarbon. With the exception of the pentanes, each hydrocarbon investigated gave an individual characteristic constant, highest critical solution temperature of stannic iodide, called a "tin point." The highest critical temperatures of solution of tin tetraiodide for hydrocarbons of equal molecular weight are virtually within the same limits of concentration of tin iodide. No maximums were observed on the curves for the pentanes but the critical solution temperature, for the same concentration of tin iodide, was higher for the branched-chain hydrocarbon than for the normal hydrocarbon. The method is applicable to quantitative analysis of binary mixtures of paraffins, since the hydrocarbon mixtures possess additive tin points. It is enough to determine the critical solution temperature of tin tetraiodide in the mixture analyzed and to make the necessary calculation by means of the corresponding curve. Tin points can also be used to determine the character of saturated residues in making a systematic study of the properties of gasoline fractions and in testing the purity of hydrocarbons which are to be identified. This method, together with qualitative analysis by Raman spectroscopy and determination of the "methyl number" in infrared spectroscopy, provides a means of quantitative analysis of three-component mixtures of isomeric hydrocarbons.

Digest from "Analysis of Hydrocarbon Mixtures by the Use of Compounds with High Internal Pressure" by A. A. Bocharov and R. D. Obolentsev, *Zhurnal Prikladnoi Khimii* 19, 492-503, 1946. (Published in Russia.)

CHEMICAL ENGINEER'S BOOKSHELF

Lester B. Pope, ASSISTANT EDITOR

One Man's War

TREASON'S PEACE—*German Dyes and American Dupes. By Howard Watson Ambruster. The Beechhurst Press, New York.* 438 pages. $3.75.

Reviewed by S. D. Kirkpatrick

THIS IS a timely, terrifying book. Today 24 top executives, chemists and engineers of I. G. Farben are being tried at Nuremberg as war criminals for backing the Nazis in "planning, preparing, initiating and waging wars of aggression and invasion of other countries; deportation to slave labor of members of the civilian populations of the invaded countries, and the enslavement, mistreatment, terrorization, torture and murder of millions of persons." Strong words indeed are these, but the reader of this book must be prepared for similar indictments of literally hundreds of American leaders of industry and state who are charged by the author with criminal connivance through their relations with the I.G. monster.

His list includes more than 250 chemical and allied companies—most of them the outstanding leaders of our industry. Even more individual industrialists, engineers, politicians, statesmen and jurists are cited for their alleged complicity—although the author, with a careful eye to the law of libel, usually hedges with weasel words to protest that not all named by him are knaves or fools. One cannot read this intemperate and badly distorted book, however, without getting the impression that throughout the years only one man has always been right, patriotic and unselfish in fighting for the public good. The rest of us have been either American dupes or German agents—and in the particular case of this magazine we are indicted for "following the line of indirect apology" for both.

Mr. Ambruster, according to the jacket of this book, "has had a long and distinguished career as a chemical engineer, and has been a consultant to many firms. He was among the first to recognize the menace of the I. G. Farben to our economy and security and has written many articles about it." His first contributions to this magazine in 1922 were concerned with the use of calcium arsenate for killing boll weevils. Later his crusading took him into the field of the pure food and drug laws, Bayer aspirin being his particular *bete noir*. This brought him into closer conflict with the Germans and in recent years his phobia has grown into the proportions of a one-man war against the I.G. and everyone in any way tainted by its contacts. To his credit, he became an intensive student of every activity in this country that in any way involved political as well as commercial relations with the German chemical trust. His services were offered without cost to numerous congressional committees, courts of justice and governmental departments. That they were seldom accepted appears to have been one of the reasons that prompted this book and particularly its diatribes against certain public officials and industrialists.

This is no place, of course, to answer such charges and allegations. Yet in reading page after page of such indictments one cannot help but compare the war records and industrial achievements of the prosecutor with such defendants as Dow, Draper, Dulles, duPont, Farish, Ford, Haslam, Howard, Merck, Mooney, Pope, Sadler, Sharples, Teagle—to list but a few from the alphabetical index. If these are the American dupes—whether fools or knaves—we are honored to be associated with them.

This book, according to the author, is "the story of democracy at its worst." But he also recognizes the fact that he can tell it, as he does, "without restraint of censor and despite opposition from high places—is democracy at its best." And may we add in the famous words of Voltaire that while we disagree with much that Mr. Ambruster says—and much more that he implies—we are glad we live in a world where he has the right to say it.

RECENT BOOKS RECEIVED

Catalytic Chemistry. By H. W. Lohse. Chemical. $8.50.

The Chemistry of Organic Compounds. 3rd ed. By J. Conant & A. Blatt. Macmillan. $5.

The Chemistry of Organic Cyanogen Compounds. By V. Migrdichian. Reinhold. $12.

Colloid Science. A symposium. Chemical. $6.

Compressed Air Handbook. Compressed Air and Gas Institute. $3.

Elementary Nuclear Theory. By H. A. Bethe. Wiley. 2.50.

Emulsion Technology. A symposium. Chemical. $6.50.

Exposition: Technical and Popular. By J. R. Gould and S. P. Olmsted. Longmans, Green. $1.75.

Flameproofing Textile Fabrics. Reinhold. $6.75.

The Heterocyclic Compounds and Organic Free Radicals. By F. Reindel & L. Anschuetz. Elsevier. $12.

Principles of Chemistry. 5th ed. By J. H. Hildebrand. Macmillan. $4.25.

Soilless Growth of Plants. 2nd ed. By C. Ellis & M. W. Swaney. Reinhold. $4.75.

Vat Dyestuffs and Vat Dyeing. By M. R. Fox. Wiley. $5.50.

Waterbury's Handbook of Engineering. 4th ed. By H. W. Reddick et al. Wiley. $2.50.

Case History of Controversy

BUNA RUBBER—*The Birth of An Industry. By Frank A. Howard. D. Van Nostrand Co., New York.* 307 pages. $3.75.

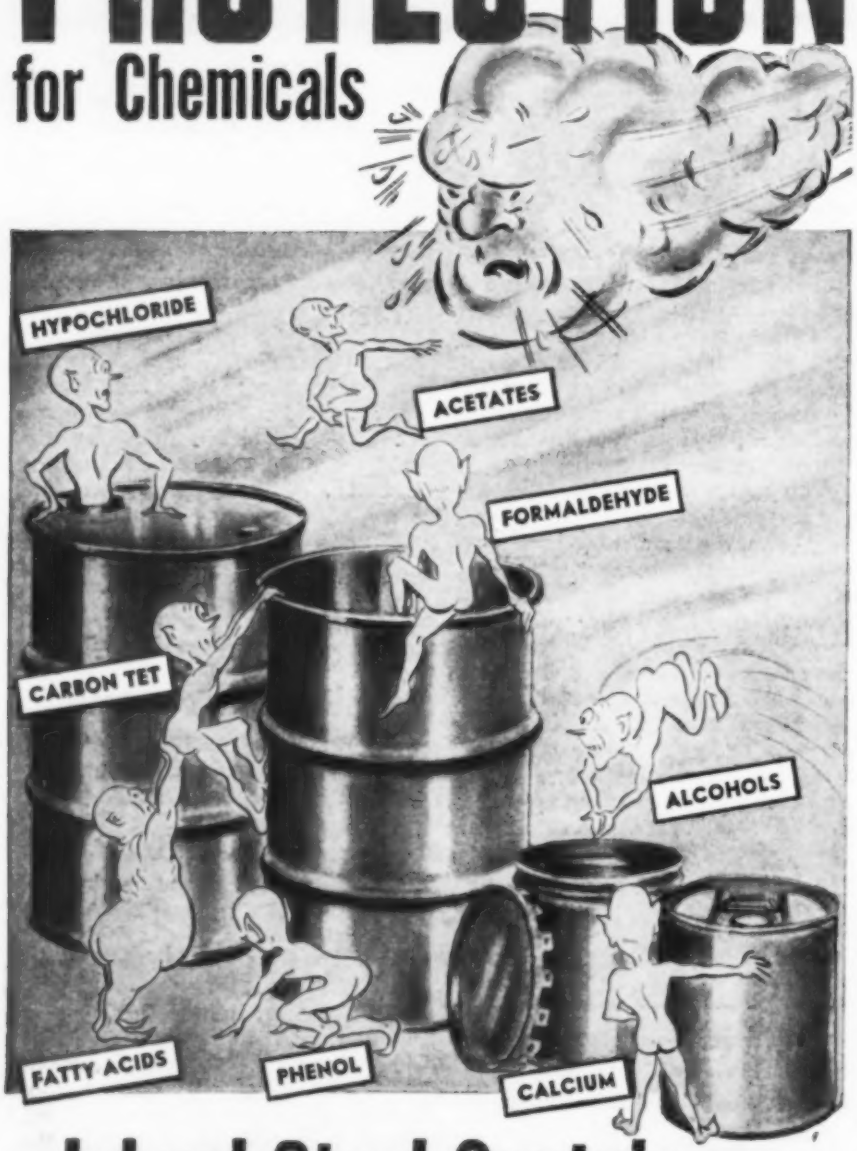
Reviewed by S. D. Kirkpatrick

THIS BOOK is an excellent antidote for *Treason's Peace*. Here one of the most maligned characters in the Ambruster diatribe presents his side of the I.G. story in a case history of the development of the American synthetic rubber industry. Considering the fact that it deals with some of the most factious controversies of our times, the author has maintained remarkable objectivity. Never once does he indulge in the caustic comment and the implicating invective that characterize the less temperate book of his accuser.

In a brief introduction, Dr. Robert A. Millikan, Nobel prize winner in physics (who somehow escaped an Ambruster indictment) noted both the high character and objectivity of the author as he paid his respects to him and Mr. Teagle for their negotiations with the late Dr. Carl Bosch and the I.G. Farbenindustrie.

The author, an engineer and lawyer by training, an international industrialist by experience, retired in 1945 after serving for 26 years as the principal executive of the Standard Oil Co. (N. J.) in charge of research,

PROTECTION
for Chemicals



Inland Steel Containers

. . . safest, sturdiest, and most convenient shipping containers for chemicals — withstand rough handling, no leakage, no spoilage; dampness and fumes do not penetrate the steel container.

Available in a wide variety of sizes and styles best suited to the product. Convenient openings make filling easy and airtight resealing after opening practical.

INLAND STEEL CONTAINER CO.
Container Specialists
6532 S. MENARD AVE., CHICAGO 38, ILLINOIS
Plants at: Chicago • New Orleans • Jersey City

technical development and petrochemical manufacturing.

Rubber Director William Jeffers said in this reviewer's presence in June 1943, "Had it not been for the research and development work carried on by the Standard Oil Co. of New Jersey prior to Pearl Harbor, the synthetic rubber program would be one and one-half to two years behind where it is now." At that time most of us had to take that statement on faith. The Jersey company had been in the center of bitter controversy in which the issues had been confused by muckraking politicians and the blind foes of big business. But now that Frank Howard has carefully compiled and published so dispassionately the whole record of the buna rubber development, it is evident that Mr. Jeffers knew what he was talking about.

All who had a part in this great wartime achievement in chemical engineering will read this book with tremendous interest. Some, to be sure, will quarrel with some of Mr. Howard's interpretations and conclusions, but none will criticize his courage and sincerity in presenting this well documented case history of what can be accomplished by American industry when "scientists, engineers and experienced production men work as a team and with adequate financial resources."

Appropriately this book is dedicated to "The Chemical Engineer, who translates advances in chemical sciences into new industries."

Manufactured Fibers

THE NEW FIBERS. *By J. V. Sherman and S. L. Sherman. D. Van Nostrand Co., New York. 537 pages. $5.*

Reviewed by W. O. Jelleme

WITH a wealth of technical detail, and with tables showing the economic aspects of production and price over the course of the years, this book tells the story of the manufactured fibers. An introduction sketches in broad strokes the use of fibers from the dawn of history 6,000 years ago to the latest fibers from the laboratories. In contrast to the natural fibers which absorb moisture, we have fibers which are practically impervious to water and others which dissolve in water; fibers which stretch and fibers which are rigid; fibers of low strength and fibers of high strength.

A chapter on the comparison of fibers gives tables which compare many of the fibers under such headings as specific gravity, tenacity, tensile strength, stiffness, toughness, modulus of elasticity, and refraction index.

The principal new synthetic fibers.

ADAMS
RUBBER LINED (CFR) AND LEAD LINED (CFL)
FILTERS

For High-Degree, Crystal-Clear Filtering of Corrosive Chemicals

- Clarification of industrial acids and corrosive liquids.
- Continuous Flow or batch operation.
- Removal of solids from liquids where the reclamation of the cake is not essential.

WITH

PORO-STONE

AND

PORO-CARBON

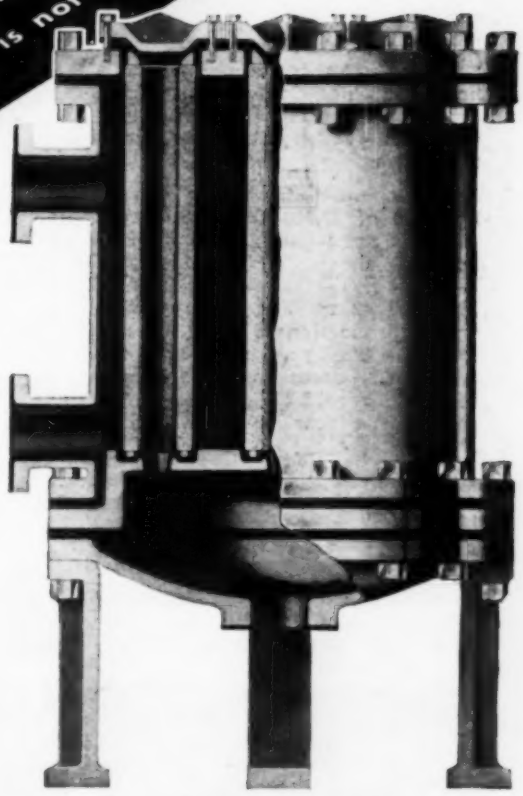
FILTER MEDIUM

INERT... Resists action of acids and alkalies.

PERMANENT... Eliminates filter medium replacement.

RIGID... Permits pressure filtering and backwashing.

HIGH DEGREE FILTRATION... Obtainable in various porosities.



TYPE CFL and CFR

1. **Totally enclosed.** Especially safe for handling hazardous liquids, as dismantling for cleaning is not necessary.

2. **Cleaned by Backwashing**... the Adams *surge tank* method. Filtered liquid under pressure is forced through the filter in reverse flow, thoroughly cleaning the pores in a few seconds.

3. **Complete Liquid Recovery.** Valuable liquids filtered completely and withdrawn before backwashing.

4. **All contact surfaces lined** to resist action of corrosive liquid.

WRITE FOR BULLETIN

for full information on construction and operation of CFL and CFR Type Filters.

R. P. ADAMS CO., INC.

207 EAST PARK DRIVE

BUFFALO 17, NEW YORK

REPRESENTATIVES IN PRINCIPAL CITIES OF UNITED STATES AND CANADA

This is the sedimentation tank for the Cochrane Cold Process Softener. Its dimensions are based on a 2 hr. retention time for softening plus storage space for 20,000 gal. backwash water for filters and zeolite softeners.

The Cochrane Water Conditioning Equipment installed at a prominent steel plant in Minnesota, is a fine example of Cochrane's ability to solve any problem having to do with the conditioning of boiler feed water.

1. A Cochrane Clarifier (Rapid Reactor) of 32,500 GPH capacity, the sedimentation tank of which appears above. The chemical feeds shown at lower left comprise coagulant and alkali tanks with proportioners and feed pumps. The proportioners are electrically controlled by an indicating, recording and integrating electric flow meter.

2. The Cochrane Vertical Pressure Filters are also shown below (right) and in the foreground an alkali tank with a stirrer for the addition of alkali to control the pH value after filtering.

3. A 3-unit Cochrane Carbite (Carbonaceous Zeolite) Softener. Maximum total rate of 543 GPM.

4. A Cochrane (Tray type) deaerator of 320,000 lbs./hr consisting of 70,000 to 270,000 lbs. of condensate at 100°F. from surface condensers. The make-up comes from the Cochrane Zeolite Softener at 50°F. Water of zero oxygen is delivered to two boilers. This installation illustrates the versatility of Cochrane equipment and attests to the wealth of experience that makes possible this versatility.

Write for recommendation on your own water problems.

Cochrane Corporation
3113 N. Seventeenth St.
Philadelphia 32, Pa.

COCHRANE
SINCE 1863

Cochrane Chemical Feed showing coagulant and alkali tanks with proportioners and feed pumps.

Cochrane Vertical Pressure Filters with an Alkali Tank in the foreground with a stirrer for the addition of alkali to control the pH value after filtering.

nylon, vinyon, and vinylidene chloride (Saran and Velon) are discussed in considerable detail, with the history of development, properties, prices, and chemistry and method of manufacture. Then follow chapters on glass fiber, polyethylene, and miscellaneous fibers, in which are covered several fibers which have not progressed beyond the laboratory and the pilot plant—the acrylonitriles, itaconic esters, polyvinyl alcohol, polystyrene, tetrafluorethylene, fiber A, polyvinyl chloride, and styrene copolymer.

The chapters on protein fibers cover the casein fiber development from early ideas and impractical processes to Lanital, produced in Italy, and our own Aralac, produced in this country. Discussion of properties, manufacture, and price are based on Aralac. Soybean fiber is reviewed from the Ford development in 1939 to the present fiber produced by Drackett. The investigations of Western Regional Laboratory in proteins from feathers, wheat, and eggs and of Southern Regional Laboratory and of Imperial Chemical Industries in peanut protein fiber are reviewed, together with the manufacture and properties of Ardil, the ICI product, and of Zein, fiber produced from corn protein by Corn Products Refining Co.

The chapters on improved rayons, and on new cellulosic fibers, are worth the study of any fiber or fabric technologist, since they cover in a short review the variations of viscose and acetate fibers which have been produced.

The review of staple fibers appears to be for completeness of the record.

Consideration of the economic aspects of rayon might well, it seems, have been given greater scope. Manufactured fibers of all sorts will be successful in their battle for place against the natural fibers only as they can offer what, in the eyes of the consumer, is greater value per dollar. Until our specialists in fabric development see the possibilities in the properties of the new fibers on an economic and promotion basis, these fibers cannot reach the markets successfully.

Research, not alone by fiber producers, but by fiber users, plays a great part in determining the rate of progress. Hence, it seems that the discussion of chemical treatments of textiles might have more attention given to the possibility of permanent finishes by chemical modification, instead of restricting it largely to the application of resins. Likewise in the introduction, the relationship between fibers and plastics might have been more completely covered by inclusion of hypotheses recently advanced to explain the molecular structures of plastics, fibers and rubbers. The book con-

Breathing is merely the oldest use for OXYGEN

• Today, industrialists expect to turn coal into gasoline, to make city fuel gas more efficiently, to reduce tremendously the time required for making steel—with oxygen.

Now that it's cheap enough.

Up to now oxygen has cost about $75.00 a ton.* Dresser Industries is engineering and equipping plants to produce oxygen at $5.00 a ton. Even less for larger plants. That's 95% pure. Or 99.5% pure!

Through Stacey-Dresser Engineering, Dresser Industries lays out the brains, but through six other member companies Dresser builds, also, the actual bones and muscle that determine the payoff of your investment: the compressors, engines, air inter & aftercoolers, reversing exchangers, regenerators, expanders, reboilers, pumps, and the numerous less spectacular components. For years many of these have been standard products of Dresser members.

What would you like to know about high purity oxygen—fantastically cheap? Dresser Industries, Inc., Terminal Tower, Cleveland 13, Ohio.

*Ton O_2=24,000 cu. ft. standard conditions.

Creative Engineering FOR INDUSTRY

with special emphasis on oil, gas and chemistry

DRESSER INDUSTRIES, INC.

BOVAIRD & SEYFANG Mfg. Co. Bradford, Pa.

BRYANT Heater Company Cleveland, O.; Tyler, Tex.

CLARK Bros. Co., Inc. Olean, New York

DAY & NIGHT Mfg. Co. Monrovia, Calif.

DRESSER Mfg. Division Bradford, Pa.

DRESSER Mfg. Company, Limited Toronto, Ont., Canada

INTERNATIONAL Derrick & Equipment Co., Columbus, Marietta & Delaware, Ohio; Beaumont, Texas; Torrance, Calif.

KOBE, Inc., Huntington Park, Calif.

PACIFIC Pumps, Inc., Huntington Park, Calif.

PAYNE Furnace Co., Beverly Hills, Calif.

ROOTS-CONNERSVILLE Blower Corp. Connersville, Ind.

SECURITY Engineering Co., Inc. Whittier, Calif.

STACEY BROS. Gas Construction Company Cincinnati, Ohio
Stacey-Dresser Engineering Division Cleveland, Ohio

ROBINSON
PROCESSING EQUIPMENT

GYRO-SIFTERS

Made in Various Types and Sizes

Model shown is motor-driven . . . equipped with special telescopic hopper for efficient, continuous feeding of various dry powder formulations.

Crushers, Grinders, Sifters, Attrition Mills . . . Material Processing Machinery of every type. Designed to your requirements by experienced engineers whose reputation is founded upon doing things right. Literature available. Inquiries invited.

ROBINSON MANUFACTURING CO.
Plant: Muncy, Pa.
SALES REPRESENTATIVE
MERCER-ROBINSON COMPANY, INC.
30 CHURCH ST., NEW YORK 7, N. Y.

NATIONAL AIROIL BURNERS

"AIROCOOL"
GAS BURNER NOZZLES
PATENTED

PREVENT OVERHEATING AND BURNING OF CASTINGS . . .

Recessed facing of refractory insulating plastic protects nozzle from extreme heat and prolongs nozzle life.

and insure stable ignition over a long, trouble-free life. Renewable type recessed gas tips direct the separate igniter flames against the main volume of the mixture to insure stable ignition . . . and allow greater turndown without burnback.

For detailed information about these long-life nozzles, write for Supplement 3 to Bulletin 55.

NATIONAL AIROIL BURNER CO., INC.
Main Offices & Factory: 1235 EAST SEDGLEY AVENUE, PHILADELPHIA 34, PA.
Texas Office: 2nd National Bank Bldg., Houston
INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

cludes with an extensive patent section.

Traditional and Provincial

DRYING OILS, THINNERS AND VARNISHES. *By John Stewart Remington. Leonard Hill, Ltd., 17 Stratford Place, London, W. 1. 144 pages. 12s.6d.*

Reviewed by Myron A. Coler

THE BOOK is divided into three major sections. Part I deals with the winning and processing of the natural drying and semi-drying oils. Part II, consisting of just ten pages, deals with paint and varnish thinners. Part III discusses an assortment of topics including natural and synthetic resins, special purpose varnishes, driers and cost computations. There is substantial overlapping of topics and no index to relieve the situation.

The viewpoint of the book is perhaps best indicated by some of the author's prefatory remarks: "At the same time looking back over the years I am convinced that all those who wish to become real craftsmen, and carry on the industry which made England the leading varnish country in the world, cannot do better than study the old methods formerly employed—methods which caused a certain leading American varnish house in Chicago to put over their yard gates 'Ye olde English varnish maker,' and which I saw when I visited the United States in 1906, for there can be no doubt that learning to run natural resins under an experienced varnish maker is the best training anyone can have, who would in these modern days aspire to making all types of varnishes whether from natural or synthetic products. I therefore make no apology for including the method I was taught in the days of my youth in the present book." In keeping with these remarks, considerable attention is devoted to traditional and provincial aspects of the subject while many more modern and technically more important developments are slighted.

The space devoted to the various materials does not correlate too well with their industrial significance, especially from the standpoint of recent American practice. Thus, e.g., four pages are allotted to sunflower oil and five pages to safflower oil whereas castor oil receives somewhat less than a single page with just two sentences on dehydrated castor oil; synthetic oils are not mentioned. Similarly, groups of extensively employed solvents, such as the higher commercial aromatic blends and alcohols, are omitted while rarer ones, such as "epichlorhydrin," are considered.

There are some peculiar spellings

LOADING: Model HA Payloader scoops up load within narrow confines of bin. One man handles entire operation, which formerly required a crew of men and wheelbarrows.

CARRYING: Model HA Payloader pauses a moment for weighing, on a batch mixing operation. Large, easy rolling wheels adapt Payloader for plant or yard use.

DUMPING: Loads are dumped exactly where desired—into bins, machines or elevators. Operator has complete visibility in all directions at all times.

You can't compete if your methods are **OBSOLETE**

Labor shortages, rising costs, production delays eat up profits rapidly. Competitive conditions today demand closer scrutiny of all costs — particularly material handling. It will pay you to investigate Hough Payloaders if you handle bulk materials; chemicals, fertilizer, clay, sand or any bulk material. They dig, load, carry, and dump; work in congested areas; unload box cars; charge bins or hoppers; work inside of plants or yards.

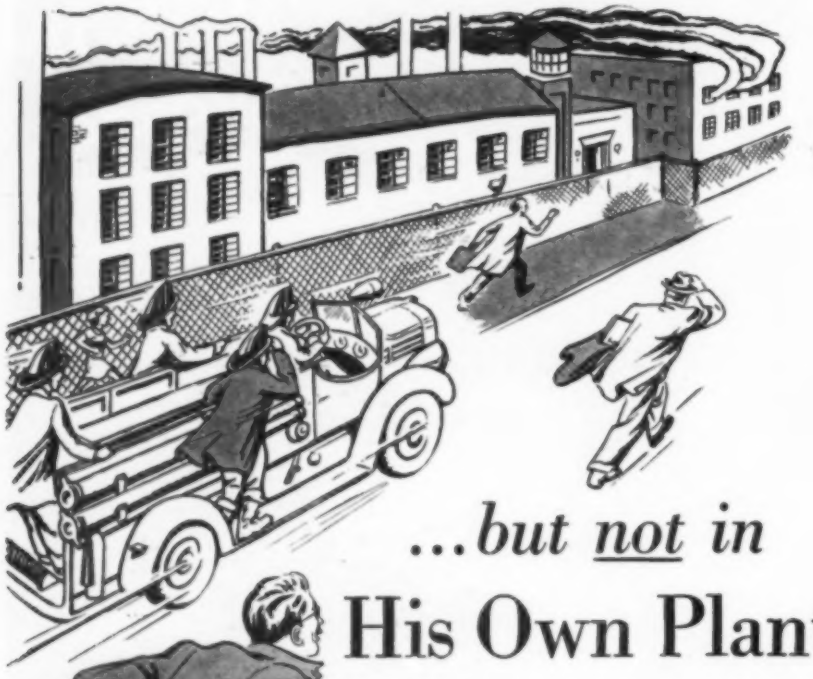
Payloaders are built in 3 sizes — the 10½ Cu. Ft. Model HA with Bucket or Lift Fork; the ¾ Yd. Model HF with Bucket, Bulldozer Blade or Crane Hook; and the 1 Yd. Gasoline or Diesel Model HL, with Bucket, Bulldozer or Crane Hook. Complete literature available on each model.

THE FRANK G. HOUGH CO.

MATERIAL HANDLING EQUIPMENT SINCE 1920

2000 Sunnyside Ave. Libertyville, Ill.

Everybody loves to see a fire



...but not in

His Own Plant

There's something exciting about a fire, but when it's your property, that's another story. Stop fires when they start with C-O-Two fire equipment. Prevent costly damage. C-O-Two is clean, modern, carbon dioxide fire protection. It's versatile; C-O-Two is used to protect electric and flammable liquid hazards of every size. It is non-conducting, non-deteriorating, harmless to the most delicate instruments.

See that your plant has C-O-Two protection. Check your dip tanks, bake ovens, spray booths, rheostats, switch panels, and other electric equipment. Don't overlook blueprint and record vaults. Then write us for a catalog or let one of our expert representatives help you plan complete C-O-Two fire protection.

C-O-TWO

C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 NEW JERSEY
Sales and Service in the Principal Cities of United States and Canada
Affiliated with Pyrene Manufacturing Company

and phrases which cannot be entirely attributed to differences between American and British terminology and practices. The author's personal observations appear to cover the great transformation period in the field of organic finishes, the period during which the empiric art which characterized the previous centuries has been slowly evolving into a chemical engineering science. A number of the observations are of historic and general interest.

Water Supply

WATER SUPPLY AND SEWAGE. *Second edition. By E. W. Steel. McGraw-Hill Book Co., New York. 666 pages. $6.*

Reviewed by Sheppard T. Powell

THE SECOND edition of the text has been prepared with emphasis on the requirements for students of sanitary engineering, rather than a text for experienced engineers in this field. It will continue to serve as a useful reference book within the field in which the author intended it should be used, namely, as a general text book for engineering students. The subject matter has been well organized and clearly presented to aid the uninformed reader on many phases of sanitary engineering. The chapters relating to chlorination, water softening, corrosion control and other operations have been amplified and brought up to date. In general, the book is recommended as a reliable book for engineering students in this field.

Age-Old Industry Up to Date

THE WATER-SOLUBLE GUMS. *By C. L. Mantell. Reinhold Publishing Corp., New York. 279 pages. $6.*

Reviewed by H. C. Parmelee

IN SPITE of progress in placing our industries on a scientific basis, an occasional exception is still found in which commerce and trade, practice and art are better established than our scientific knowledge. Such is the case with those complex substances known as gums which have been the basis of an industry since Biblical times. Hence the author of this volume renders a service to science and industry in coordinating current information and revealing the gaps in our knowledge of an important group of commercial substances.

Considering the extensive geographical sources of gums and their varied industrial uses, it is not surprising that confusion exists in their nomenclature and classification. The author limits the group to tree exudations, seaweed colloids, seed extracts, manufactured

FOLLOW-THROUGH!

That's the keynote of Wyandotte Technical Service. Every step of the way—from the first sample of the chemical adapted to meet your needs to the sale of your finished product—this complete service is at work for you.

Today, as in the past, experienced Wyandotte Technical Service Men are advising many Wyandotte customers in such problems as the design of chemical storage facilities and processing equipment . . . in the proper methods of handling, sampling, analyzing and using bulk chemicals.

All of this adds up to greater value for you in Wyandotte Chemicals. If you have any problems concerning the chemicals listed below, *why not ask Wyandotte?*

WYANDOTTE CHEMICALS CORPORATION
WYANDOTTE, MICHIGAN • OFFICES IN PRINCIPAL CITIES

Soda Ash • Caustic Soda • Bicarbonate of Soda • Calcium Carbonate • Calcium Chloride • Chlorine • Hydrogen • Dry Ice • Glycols
Ethylene Dichloride • Propylene Dichloride • Chloroethers • Aromatic Sulfonic Acid Derivatives • Other Organic and Inorganic Chemicals

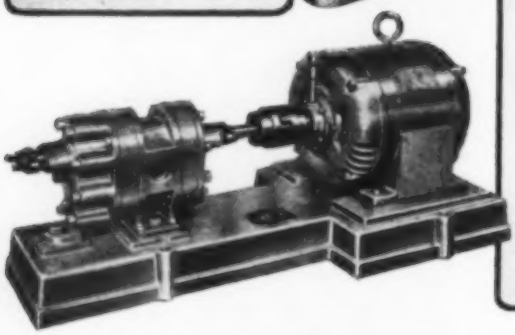
Wyandotte
REG. U. S. PAT. OFF.

ONE PUMP working on the job is *worth a dozen* in the repair shop!

SIER-BATH SCREW PUMP

Advantages: • pulseless flow • anti-friction bearings • vibrationless operation • low maintenance cost • rugged construction.

Pumps: Acetate, asphaltz, brines, Bunker C Fuel Oil, Cellulosics, Greases, Molasses, Syrups, Lube Oils, etc.



SIER-BATH GEAREX PUMP

• Balanced Axial Thrust • Pulseless Flow • Vibrationless Operation • Roller Bushings for Precision Running under load.

Pumps: Oils, Varnishes, Solvents, Molasses, Chemical Solutions.

Capacities: 1-550 g. p. m.

Discharge: 250 p. s. i. for medium or high viscosities. 50 p. s. i. for water.

The most notable point about SIER-BATH Screw Pumps and Gearex Pumps is their relative freedom from maintenance.

THERE is no mystery about the ability of Sier-Bath Pumps to stand up under the most trying conditions. After all, in such pumps, the worms and gears are the most important parts. And when you consider that Sier-Bath Pumps are made in the best equipped precision gear shop in the country, it is easy to understand their exceptional dependability. Their pulseless flow and vibrationless operation greatly reduce maintenance cost—there is much less wear on valves, couplings and other fittings. Pipes and joints remain tight. With labor costs at their present high figures, these are important points to consider in pump selection. Send for descriptive booklet.

ALSO MAKERS OF SIER-BATH PRECISION GEARS

FOUNDED 1905 **MEMBER A. G. M. A.**

Sier-Bath
GEAR and PUMP CO., Inc.

9259 HUDSON BOULEVARD • NORTH BERGEN, NEW JERSEY

dextrins, and water-dispersible derivatives of cellulose. Proteins are excluded, although a discussion of gelatin is given because of its many gum uses.

The general plan of the book is to treat the industrial and scientific aspects of gums according to their natural sources as indicated above. This is supplemented with chapters on the commercial uses of gums in industry. A chapter on specifications, identification and testing rounds out the commercial aspect of the subject.

Data Collection

MANUAL FOR PROCESS ENGINEERING CALCULATIONS. *By Loyal Clarke. McGraw-Hill Book Co., New York. 438 pages. $6.*

Reviewed by R. L. Pigford

THIS addition to the well-known "Chemical Engineering Series" fills a need for a brief collection of working formulas, charts, and data which can be used rapidly by chemical engineers and others who have to present quick order-of-magnitude answers to design problems. The book does not take the place of more extensive handbooks, which present a wider variety of data in more detailed form, or of standard texts and reference books, which give more comprehensive treatments of basic theory. Many chemical companies maintain handbooks of data and most practicing engineers have their own limited collections of frequently used charts. Essentially, the author has presented an extensive and excellent collection of this sort.

Following brief chapters on mathematical data and conversion tables, there is a brief, well-organized collection of physical, mechanical, and chemical properties of process fluids and construction materials. Thermodynamic data follow, including fluid densities, thermal properties of fluids, and data for chemical equilibrium and reaction heat calculations. A chapter on piping, hydraulics, and flow measurement includes convenient tables from which pressure drop may be read for flow of any common liquid through standard pipes up to 20 in. diameter. The chapter on heat transfer is based mainly on convenient tables and alignment charts, largely reprinted from other sources, from which individual heat transfer coefficients may be estimated quickly for the usual geometrical arrangements and flow conditions. The stoichiometric procedures used in combustion are illustrated and typical analyses and heating values of solid, liquid, and gaseous fuels are given. The operating characteristics of pumps, fans, blowers, and compressors are discussed. Desig

Another

EDGE MOOR ACHIEVEMENT

IN PROCESS EQUIPMENT FABRICATION

This hemispherical bottom varnish kettle, five feet in diameter, ten feet high with a one-inch thick bottom is *another* EDGE MOOR achievement in process equipment fabrication . . . a direct result of EDGE MOOR experience, facilities and proficiency.

EDGE MOOR is equipped to furnish *any type* of heavy-wall welded fabrication to your individual designs, specifications or requirements . . . in metal thicknesses up to 2½". Materials include:

CARBON STEELS	MONEL	INCONEL
STAINLESS STEELS	HERCULOY	NICHROME
CLAD STEELS	HIGH CHROME	EVERDUR
NICKEL STEELS	18-8 ALLOYS	NICKEL

EDGE MOOR Shops have complete facilities for stress-relieving, annealing and X-ray . . . and are approved by leading insurance companies for fusion welding to meet all codes and tests. We shall be pleased to place our experience and facilities at your disposal when you are considering additional plant equipment.

EDGE MOOR IRON WORKS, INC. • Main Office and Works: Edge Moor, Del. Branch Offices and Agents: 95 River Street, Hoboken, New Jersey • 7 Water Street, Boston, Massachusetts • P. O. Box 9, Station E, Atlanta, Georgia • 2459 Woodward Avenue, Detroit, Michigan • One N. LaSalle Street, Chicago, Illinois • 2295 University Avenue, Saint Paul, Minnesota • 623 Aztec Building, San Antonio 5, Texas • 141 Second Street, San Francisco, Calif.

EM

edge moor fabricators of process equipment

When Versatility is a Must!

So often, versatility is the only answer to handling a situation successfully and efficiently . . . and versatility is what you buy with the STOKES & SMITH Universal Filling Machine.

Our various customers fill more than 150 different kinds of materials on the Universal Filler . . . Drugs . . . Cosmetics . . . Foods . . . and other household products. Powders and pastes and free-flowing materials. Products which must be packed and crowded into the container; products which must be handled gently, without pressure. (In fact, everything but solids and liquids). And, so versatile is this Filler that one customer fills 38, another 31, and another 24 *different kinds of materials on one machine.*

Also available—Automatic types with speeds up to 120 per minute.

STOKES & SMITH Co

4914 Summerdale Ave., Philadelphia 24, U. S. A.

FILLING : PACKAGING : WRAPPING MACHINES

SPEEDS TO SUIT YOUR NEEDS — 15 - 30 - 60 - 120 PER MINUTE

"Better machines for better packages"

of equipment for absorption, stripping, and distillation is discussed rather briefly in a single chapter, and this is followed by a final chapter on water treatment and cooling towers.

Although omission of many types of data is justified for the sake of brevity, additional information on a few subjects might have proved generally useful. These include pressure drop across tube banks and packed, irregular solids, radiation from hot gases, furnace design, and thermal conductivities of liquids and gases. No information is given on the estimation of minimum and operating reflux ratios for distillation calculations involving more than two components. The inclusion of the generalized curves of Gilliland or Brown would have been a convenient way of handling number-of-plates calculations for both multicomponent and binary systems.

This book should be useful to the practicing chemical engineer. In addition, it should be of interest to students since a brief study of its contents gives an excellent idea of the nature of the design engineer's job. The concise statements throughout the book on questions of common engineering practice and the introductory chapter on "Perspective" in design work should be of particular interest to students.

Gas Proceedings

AMERICAN GAS ASSOCIATION PROCEEDINGS, 1946. *Published by the Association, 420 Lexington Ave., New York. 550 pages. $3 to members, $7 to nonmembers.*

NOWHERE else does the technical man or the technical library get complete printing of the important contributions at the annual meeting and the various divisional meetings of AGA. This volume is a "must" for every industrial or individual library which pretends to keep a good file of important fuel engineering information.

RECENT BOOKS and PAMPHLETS

Pioneers in Oil Cracking. By Robert E. Wilson, Standard Oil Co. (Indiana). 27 pages. History and chemistry of early gasoline production. An address before the Newcomen Society, American Branch.

Pulp and Paper Manufacture. Compiled by C. J. West. Published by the Technical Association of the Pulp and Paper Industry, 122 East 42nd St., New York. 275 pages. Bibliography, 1946 and U. S. Patents 1945-1946.

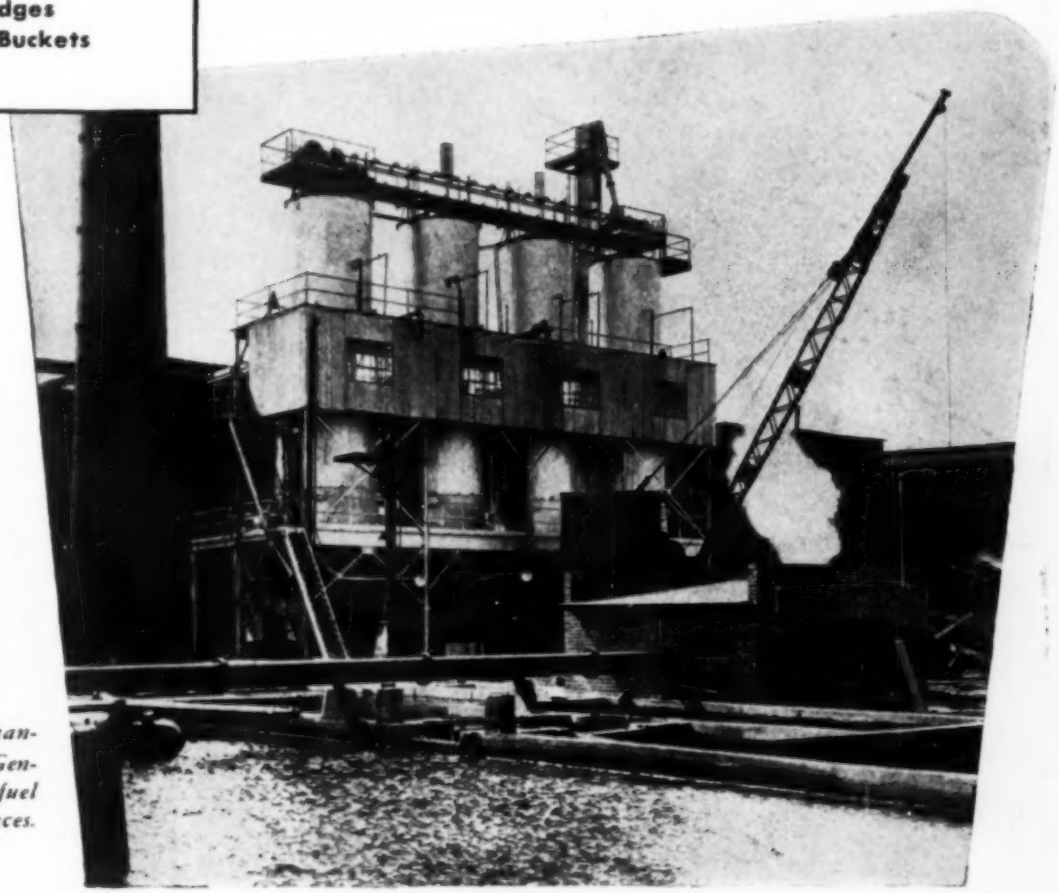
Make Your Town Safe! By Herbert Yahraes. Public Affairs Pamphlet No. 133, published by the Public Affairs Committee, 22 East 38th St., New York

Wellman will build it

Special Cranes
Gas Producer Plants
Charging Machines
Industrial Furnaces
Car Dumpers
Gas Flue Systems
Gas Reversing Valves
Coke Pushers
Mine Hoists
Skip Hoists
Ore Bridges
Clamshell Buckets

Wellman-Galusha Clean Gas Generators

Built exclusively by Wellman

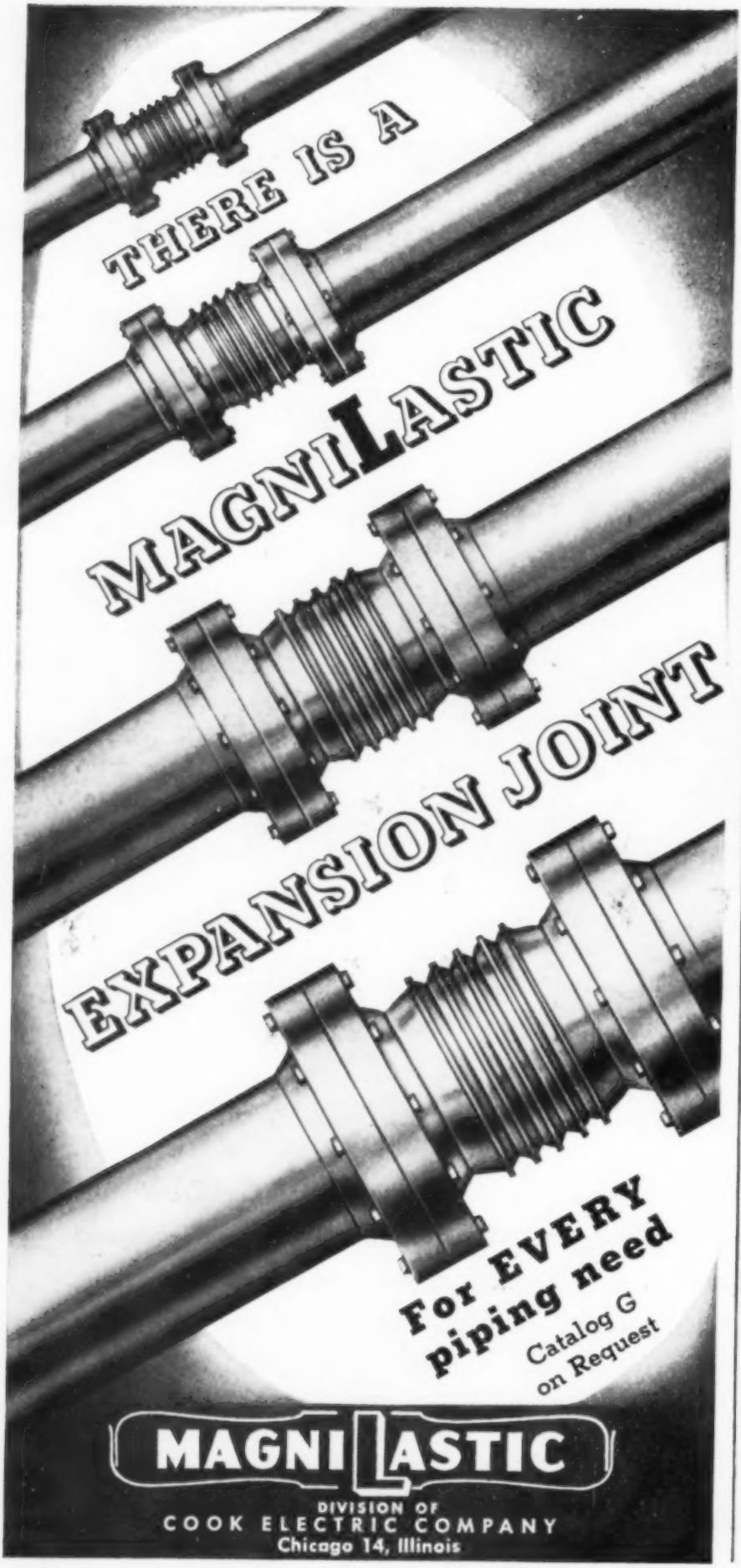


Four 10 ft. Wellman-Galusha Clean Gas Generators supplying fuel for steel mill furnaces.

• Only Wellman builds the Galusha Clean Gas Generators that so ideally meet your requirements with efficiency and economy. These generators combine, in a *complete* machine, the rotary grates, ample fuel storage bin, and provisions for generating the steam required for making the gas. Even the lowest-priced grades of Anthracite and coke can be satisfactorily gasified.

THE WELLMAN ENGINEERING COMPANY

7032 CENTRAL AVENUE • CLEVELAND 4, OHIO



16, N. Y. 32 pages. 20 cents. A discussion of how a community may be organized for accident prevention.

Tables of Spherical Bessel Functions, Vol. II. Prepared by the Mathematical Tables Project, National Bureau of Standards. Published by the Columbia University Press, 2960 Broadway, New York, N. Y. 332 pages. $7.50. Tables of $(\pi/2x)^{1/2}J_v(x)$ for $\pm v$ ranging from 29/2 to 61/2. This set of tables complements those previously published in Vol. I.

Table of the Bessel Functions $J_0(z)$ and $J_1(z)$ for Complex Arguments. Second Edition. Prepared by the Mathematical Tables Project, National Bureau of Standards. Published by Columbia University Press, 2960 Broadway, New York, N. Y. 408 pages. $7.50.

Price List of American Standards. Published by the American Standards Association, 70 East 45th St., New York, N. Y. 24 pages. Gratis. An entire new listing of its 874 standards now available.

Heat Treatment of Carbon Steels. By F. Johnson. Chemical Publishing Co., Brooklyn 2, N. Y. 206 pages. $4. Influence of composition and treatment on structure and properties, practical operations, hardenability and testing—a British publication.

The Comparative Explosion Hazard of Ammonium Nitrate Containing Organic Matter. Published by the Underwriters' Laboratories, 161 Sixth Ave., New York 13, N. Y. 28 pages. Discussion in two parts of the factors known to influence the sensitiveness of ammonium nitrate to explosion and the comparative sensitiveness under fire conditions of ammonium nitrate compositions.

Unloading Phenol from Tank Cars. Manual Sheet TC-6 published by the Manufacturing Chemists' Association, 608 Woodward Building, Washington 5, D. C. 12 pages. 20 cents. Supplement to the MCA chemical safety data sheet on phenol discussing this time various methods of safely unloading phenol from tank cars.

Chemical Compounds Formed from Sugars by Molds. By B. S. Gould. Scientific Report Series No. 7 published by the Sugar Research Foundation, 52 Wall St., New York, N. Y. 17 pages. Compilation of the chemical products that are produced by molds from sucrose and which have been reasonably well identified to date.

Plant Location Directory of Basic Chemical Products. Published by the Tennessee State Planning Commission, Nashville, Tenn. 13 pages. $1. Listings for the entire United States on the following: anhydrous ammonia, caustic soda, hydrochloric acid, industrial alcohol, liquid chlorine, nitric acid, salt and brine, soda ash, sulphuric acid and sulphur.

Practices in Collection and Maintenance of Information on Highly Trained and Specialized Personnel in the United States. Prepared by Lowell H. Hattery. Published by the National Research Council. 137 pages. This report to the Conference Board of the Associated Research Councils explores the experiences and practices of the National Roster of Scientific and Specialized Personnel.

Forest Resources of Chile. A report prepared by the U. S. Forest Service in cooperation with the Chilean government agency, "Corporacion de Fomento de la Produccion." This mimeographed document describes the investigation made by a group of United States representatives who formed the Chilean Forestry Mission to study the forest resources of Chile as a basis for industrial expansion. Available in limited supply from the chairman of the Mission, Dr. I. T. Haig, Southeastern Forest Experiment Station, Federal Building, Asheville, N. C.

Symposium on pH Measurement. Technical Publication No. 73, published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 79 pages. $1.50. Papers and discussions on colorimetric and potentiometric methods for making pH and closely related measurements which were presented at the Forty-Ninth Annual Meeting of ASTM in Buffalo.

The bean that did an about face

Until recently the soybean was the most stubborn bean ever to plague a laboratory.

Under precise laboratory conditions soybean oil proved to be rich in substances sorely needed by industry. But when it came to projecting these results in terms of large scale commercial operations, soybean oil simply refused to cooperate.

Ordinary refining methods were unable to isolate and separate many of the substances that science knew the soybean contained. Paint oil molecules clung to edible oil fractions, affecting the value of both. Oil fractions useful for plastics remained mixed with components sought by pharmaceutical and cosmetics industries.

And so it went—until M. W. Kellogg engineers developed the revolutionary new Solexol Process for refining vegetable, animal and marine oils according to molecular weight and structure.

Thanks to Solexol the unstable characteristics in soybean oil are now under control. High quality edible oils, paint oils, pigment lecithin and sterol concentrates can be produced from soybean oil—to exacting laboratory specifications—at the lowest refining cost in history!

Solexol's remarkable success in the processing of soybean oil is applicable to the refining of other non-mineral oils such as cottonseed oil, fish body and fish liver oils, fats and tallows. Production data on a wide range of products may be had by writing Glyceride Processes Division, The M. W. Kellogg Co., 225 Broadway, N. Y. 7, N. Y.

SOLEXOL

Decolorizes, separates, extracts, concentrates and deodorizes

VEGETABLE OILS

Soybean Peanut Cottonseed
Linseed Tall Other similar types

ANIMAL PRODUCTS

Tallows Waxes Greases

MARINE OILS

Fish body oils and liver oils having widely different physical, chemical and vitamin-potency characteristics.

FATTY ACIDS From all sources

Licensed jointly by The M. W. Kellogg Co. and The Chemical Foundation, Inc.

Copyright 1947, The M. W. Kellogg Company, New York

GLYCERIDE PROCESSES DIVISION

THE M. W. KELLOGG COMPANY

A SUBSIDIARY OF PULLMAN, INC.

Engineers and Economists to International Industry

NEW YORK JERSEY CITY LOS ANGELES TULSA HOUSTON TORONTO LONDON PARIS

Conference in a Rowboat

Jim: Yes, sir, this is the life! And I left everything under control at the office except just *one* problem — those heat exchangers for the new plant!

Bill: If that's your only worry, relax and enjoy yourself. Whitlock can handle that job for you and do it right.

Jim: So I hear, but they're way off in Hartford, Connecticut. I can hardly expect them to send a man to study our job.

Bill: That's right — *if* their man had to to come from Hartford! But don't forget that Whitlock has forty or fifty direct sales offices and representatives all over the country, working on jobs like yours.

Jim: But some of my jobs are pretty complex, probably too difficult for most field engineers — what then?

Bill: Very simple — the field engineer's recommendations are all mailed to Hartford and reviewed by their Thermal and Production Engineering Divisions immediately. If necessary, a specialist from Hartford comes out to look the job over.

Jim: Bill, you're the guy who knows *all* the answers! That equipment has had me worried. I hadn't realized there was a *local* Whitlock man who could drop in to talk things over. Now, a phone call should settle my problem.

There's an experienced Whitlock representative near you. Ask his advice on your heat transfer problems and follow his recommendations.

THE WHITLOCK MANUFACTURING CO.

94 South Street, Hartford 1, Conn.

New York • Chicago • Boston • Philadelphia
Detroit • Richmond

Authorized representatives in principal cities.
In Canada: Darling Bros., Ltd., Montreal

WHITLOCK EQUIPMENT

AHEAD OF THE TIMES FOR HALF A CENTURY

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give complete title and the issuing office. Remittance should be made by postal money order, coupons, or checks. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the bureau responsible for its issue.

A Guide for Reducing Fuel Consumption in Commercial Plants. By J. F. Barkley, et al. Bureau of Mines, Bulletin 466. Price 50 cents.

Experiment in Underground Gasification of Coal, Gorgas, Ala. By James J. Dowd, et al. Bureau of Mines, Report of Investigations R. I. 4164. Mimeographed.

Diamond Drilling of Potash Reserves in Eddy County, New Mexico. By Walter R. Storms. Bureau of Mines, Report of Investigations R. I. 4098. Mimeographed.

Arizona Asbestos Deposits, Gila County, Arizona. By Lincoln A. Stewart and P. S. Haury. Bureau of Mines, Report of Investigations R. I. 4100. Mimeographed.

Rusk Iron Deposits, Cherokee County, Texas. By A. M. Evans and J. H. Soulé. Bureau of Mines, Report of Investigations R. I. 4115. Mimeographed.

Northgate Fluorspar, Jackson County, Colo. By John D. Warne. Bureau of Mines, Report of Investigations R. I. 4106. Mimeographed.

Inside Wall Paint for Chemical Laboratories (Fume-Resisting Enamel Paint). National Bureau of Standards, Letter Circular LC861. Mimeographed.

Wood and Shingle Stains. National Bureau of Standards, Letter Circular LC-867. Mimeographed.

Detergents and Detergent Aids. National Bureau of Standards, Letter Circular LC868. Mimeographed.

Industrial Uses of Selected Minerals. U. S. Department of Commerce, Industrial Series No. 72. Price 30 cents.

Gypsum Board Trends. Bureau of Foreign & Domestic Commerce, Construction and Construction Materials Industry Report, September 1947. Processed.

Classified List of O.T.S. Printed Reports. PB-81500. Order from Office of Technical Services, Department of Commerce, Washington 25, D. C. Price 75 cents. Catalog of 1,300 reports on German technology.

Bibliography and Index of OSRD Reports. PB-78000. Order from Office of Technical Services, Department of Commerce, Washington 25, D. C. Price 75 cents.

List of Translated German Documents. Free on request to Office of Technical Services, Department of Commerce, Washington 25, D. C.

Training Within Industry Report, 1940-1945. War Manpower Commission. Price 50 cents.

Union-Security Provisions in Collective Bargaining. Bureau of Labor Statistics, Bulletin No. 908. Price 15 cents.

Analyses of Arizona, California, Idaho, Nevada, and Oregon Coals. By David A. Andrews, et al. Bureau of Mines, Technical Paper 696. Price 25 cents.

Exploration, Reserves, Bed Characteristics, and Strip-Mining Possibilities of a Lignite Deposit Near Toledo, Lewis

YOU'RE ALWAYS SURE With A LIQUIDOMETER Tank Gauge

WRITE for COMPLETE DETAILS

"LIQUIDS WORTH STORING ARE WORTH MEASURING"

THE LIQUIDOMETER CORP.
36-29 SKILLMAN AVE., LONG ISLAND CITY 1, N.Y.

the De Laval single inlet blower

This De Laval blower has been designed and constructed to meet the most exacting service with the utmost reliability and efficiency. The heavy, cast casing is smoothly finished and scientifically contoured. The vanes of the built-up forged steel impeller are curved to assure stable flow characteristics. A Kingsbury type thrust bearing is employed in place of ball or collar type thrust bearings. The sleeve type bearings in the pedestal are pressure lubricated. The case rings are replaceable. The discharge opening may be positioned at any angle in 15° increments for either direction of rotation.

C-5

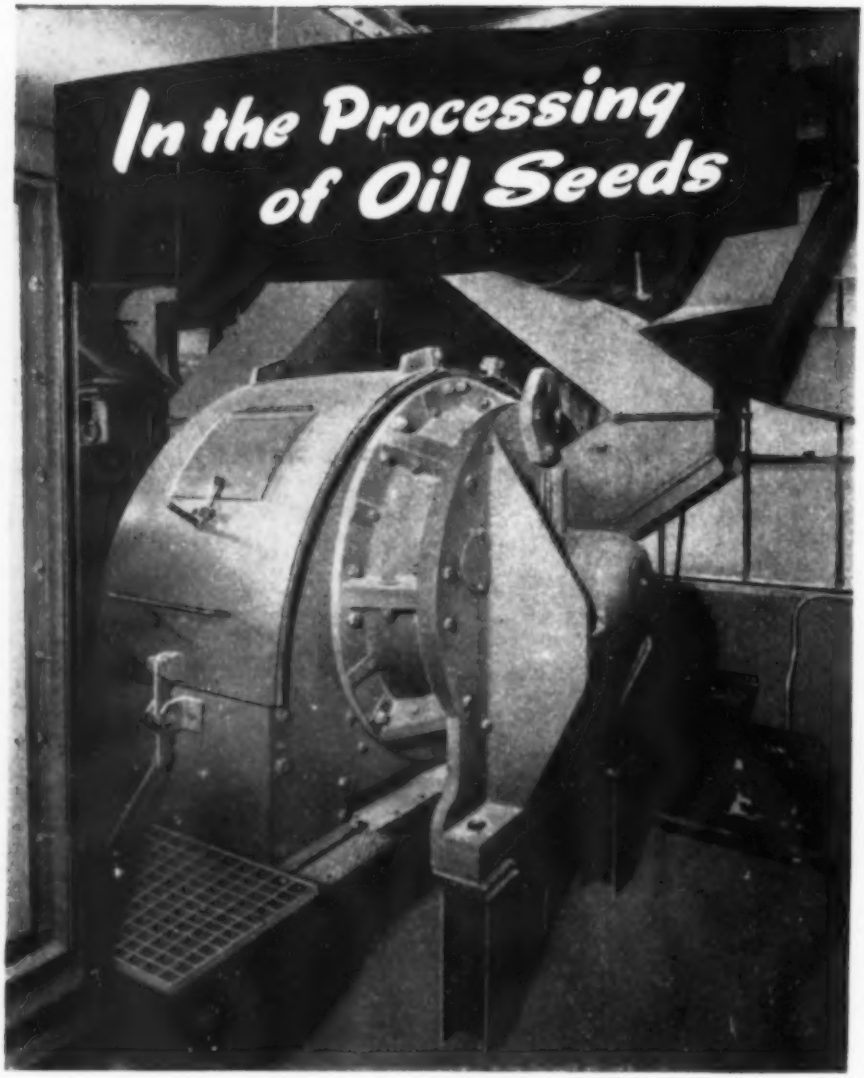
DE LAVAL

STEAM TURBINE CO.

TRENTON 2, NEW JERSEY

Atlanta • Boston • Charlotte • Chicago • Cleveland • Denver • Detroit • Helena • Houston • Kansas City
Los Angeles • New Orleans • New York • Philadelphia • Pittsburgh • Rochester • Salt Lake City
San Francisco • Seattle • St. Paul • Tulsa • Washington, D. C. • Edmonton • Toronto • Vancouver • Winnipeg

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS



Soya beans, linseed, cottonseed, are all seeds of a plant.

The aim of every processor, of all research, has two major ends in view—first, the maximum yield of oil—second, the maximum salability of the meal.

In every phase of the processing cycle, where reduction is required, two important factors recur: first, the need of the granular grind; second, uniformity of the grind.

Meeting those aims and needs in co-operation with the oil seed industries, brought the Prater Pulverizer to its position of leadership for the reduction phase of both expeller and solvent processes—wherever and whenever yield and quality are important.

Write for Detailed Information

PRATER PULVERIZER COMPANY
1501 South 55th Court, Chicago 50, Ill.

PRATER PULVERIZERS

County, Wash. By Albert L. Toenges, et al. Bureau of Mines, Technical Paper 699. Price 35 cents.

Sound Absorption Coefficients of the More Common Acoustic Materials. National Bureau of Standards, Letter Circular LC870. Mimeographed.

Bibliography of Some Recent Research in the Field of High Polymers. National Bureau of Standards, Letter Circular LC871. Mimeographed.

Gas Turbines and Jet Propulsion. National Bureau of Standards, Letter Circular LC872. Mimeographed.

Tentative Spectrophotometric Method for Determination of Rutin in Various Preparations. By W. L. Porter, et al. Bureau of Agricultural and Industrial Chemistry, AIC-159. Processed.

Extraction and Refining of Rutin from Green Buckwheat. By J. F. Couch, et al. Bureau of Agricultural and Industrial Chemistry, AIC-160. Processed.

Kiln Drying. A group of recent reports has been issued by and is available from Forest Products Laboratory, Madison, Wis., on this general subject. The following items have broader implications than mere kiln drying of wood: Construction and Use of Graphs in Kiln Drying Lumber, by K. E. Kimball, Report No. R1659. Circulation of Air in a Lumber Dry Kiln, by O. W. Torgeson, Report No. R1678. Relative Humidity and Equilibrium Moisture Content Graphs and Tables for Use in Kiln Drying Lumber, by Harvey H. Smith, Report No. R1651. Drying Stresses in Lumber Seasoning, by W. J. Baker, Report No. R1652. Effect of Piling Methods on Air Circulation in a Lumber Dry Kiln, by O. W. Torgeson, Report No. R1653.

The Federal Research Program. Volume two of Science and Public Policy. A report to the President by The President's Scientific Research Board. Price 55 cents.

Administration for Research. Volume three of Science and Public Policy. A report to the President by The President's Scientific Research Board. Price 55 cents.

Manpower for Research. Volume four of Science and Public Policy. A report to the President by The President's Scientific Research Board. Price 35 cents.

The Nation's Medical Research. Volume five of Science and Public Policy. A report to the President by The President's Scientific Research Board. Price 25 cents.

Synthetic Organic Chemicals; United States Production and Sales, 1946. (Preliminary). U. S. Tariff Commission. Mimeographed.

Missouri Basin Studies No. 12. Map showing construction materials and nonmetallic mineral resources of South Dakota. Order from U. S. Geological Survey, Washington 25, D. C. Price 60 cents.

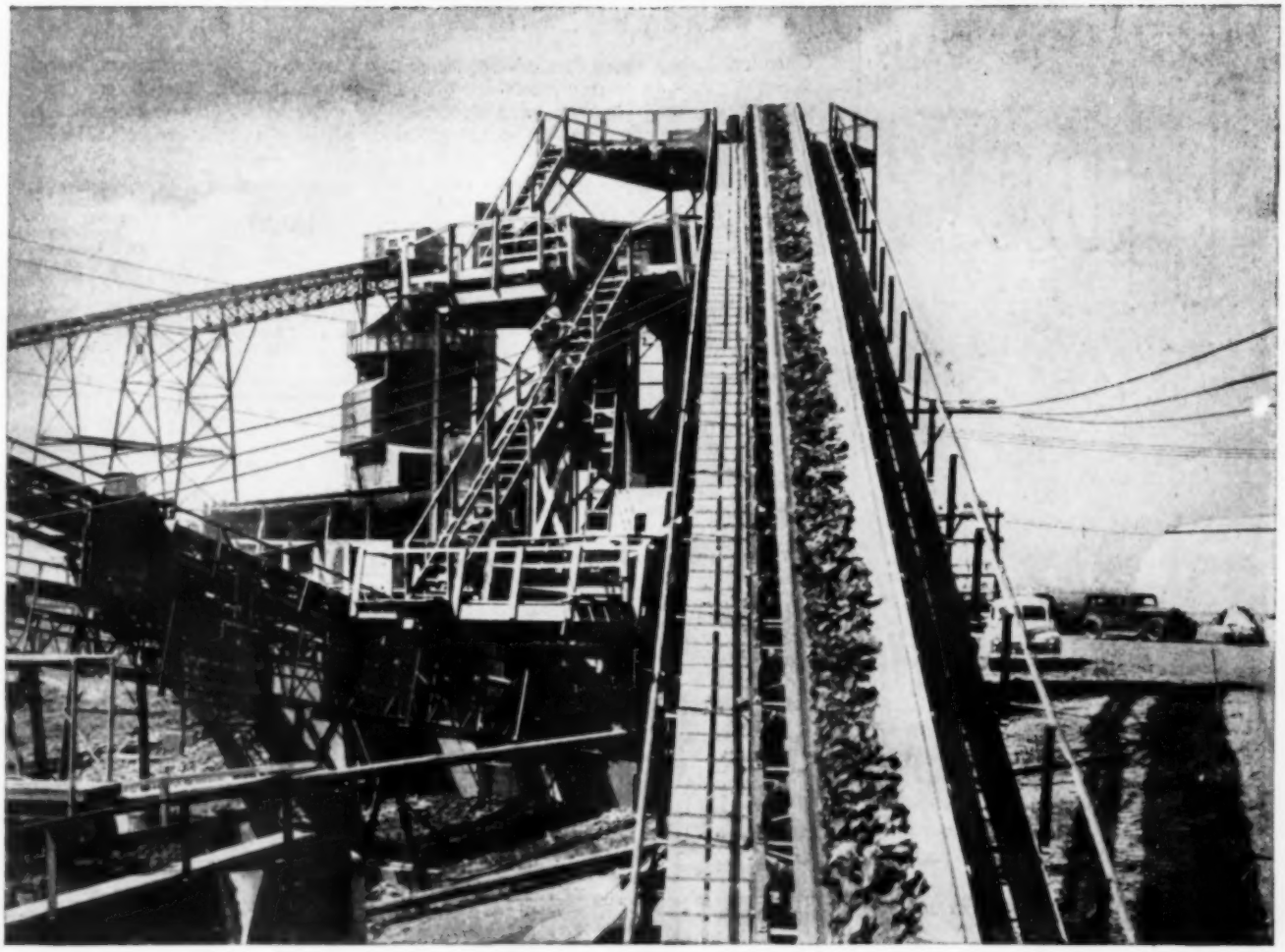
Water Levels and Artesian Pressure in Observation Wells in the United States in 1944. By A. N. Sayre and others. Part 1. Northeastern States. Geological Survey Water-Supply Paper 1016. Price 65 cents. Part 5. Northwestern States. Geological Survey Water-Supply Paper 1020. Price 40 cents.

Food at the Grass Roots; The Nation's Stake in Soil Minerals. Tennessee Valley Authority. Price 30 cents. Fertilizer Promotion.

DDT for Control of Household Pests. Prepared by U. S. Department of Agriculture and U. S. Public Health Service. Unnumbered. Price 5 cents.

Russian Dandelion (kok-saghyz): An Emergency Source of Natural Rubber. By W. Gordon Whaley and John S. Bowen. U. S. Department of Agriculture, Miscellaneous Publication 618. Price 55 cents.

A Third Digest of the Literature on DDT (January through June 1945). By R. C. Roark and N. E. McIndoo. Bureau of Entomology and Plant Quarantine, E-728. Processed.



Uphill work that's easy

Moving tons and tons of material *uphill* sounds like a mighty tough job.

Actually, it's easy when you install Maltese Cross conveyor and elevator belting. Progressive mining and quarry operators the country over have insisted on this famous belting for more than a generation.

You'll find this belting unusually strong, flexible, and long-lasting. In fact, it's built to such premium standards that Hewitt had to suspend its manufacture during the war because the use of top-quality materials was restricted.

Here's why you, too, will always want to insist on famous Maltese Cross conveyor and elevator belting:

1. **Special Hewitt-developed rubber compounds give Maltese Cross maximum resistance to impact, abrasion, weathering, aging, heat, sun-checking.**
2. **Selected staple cotton reinforcement makes Maltese Cross extra strong, reduces stretch.**
3. **High-flexing, resilient rubber frictioning between plies provides maximum adhesion.**
4. **Scientifically treated belt carcass virtually eliminates mildew from Maltese Cross.**
5. **Extra layers of highly elastic skim rubber give Maltese Cross added cushioning to shock loads and assure perfect troughing.**
6. **Special Dura-bond breaker strip on Maltese Cross permanently anchors cover to carcass.**

Plan now to put Maltese Cross conveyor and elevator belting to work for you. It is available in straight-ply, stepped-ply or shock-pad construction. Phone your Hewitt distributor listed in the yellow pages of your telephone directory. Or write Hewitt Rubber Division, 240 Kensington Avenue, Buffalo 5, N. Y.

You can depend on your industrial supply specialist

He's always ready to serve you. And he knows your job . . . your operations . . . your problems. Call on him at any time for advice. He'll recommend the exact Hewitt product especially designed to help *improve* the efficiency of your operations.

HEWITT RUBBER
DIVISION
HEWITT-ROBINS INCORPORATED
INDUSTRIAL HOSE • BELTING • PACKING

Maltese Cross Belting

WHAT, NO Wires?

NOT IN LEKTROMESH

Lektromesh . . . the new, one-piece solid metal-plated screen is made by electrodeposition . . . supplements rather than competes with woven wire. Continuous production methods permit runs of 100 foot rolls up to 35 inches in width of 40 to 120 mesh . . . meshes 150 to 400 in smaller units . . . and is furnished in nickel and copper. This unique product presents a smooth surface and is readily fabricated by stamping, welding and soldering. Combining accuracy and uniformity of openings with the smoothness of perforated metals, Lektromesh applications are unlimited. Ideal for strainers in fuel systems, dry-screening and a large number of specialized items. Distinct value lies in its even plane surface that withstands wear when exposed to doctor blades and scrapers as in continuous filters and its unique ability to screen material with minimum clogging.

Lektromesh folder and small sample available. Write Dept. 204

DIPPING BASKETS • LEKTROMESH • RESISTANCE WIRE • WIRE MESH PARTS • WIRE CLOTH • STRAINERS • FILTERS

The C. O. JELLIFF MANUFACTURING CORPORATION

SOUTHPORT, CONN.

WIRE PRODUCTS jelliff SINCE – 1880

MANUFACTURERS' LATEST PUBLICATIONS

Chemical Engineering's Reader's Service, in cooperation with manufacturers, makes it possible for you to secure catalogs, bulletins, and other publications herein listed without obligation (unless a price is specifically mentioned). For your convenience, publications may be obtained by using Reader Service Coupons on pp. 171-172.

tures the various types of valves in this company's line. Includes a specification guide.

116. Equipment. Industrial Ovens, Inc., Cleveland, Ohio.—12-page brochure describing the continuous extrusion takeup equipment made by this company. Contains schematic drawings showing the use of the equipment. Includes dimensions and engineering data.

117. Resins. Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y.—4-page bulletin outlines this company's phenolic resins for making compounded rubber stocks and solvent-type adhesives.

118. Air Conditioning. Surface Combustion Corp., Toledo, Ohio.—8-page booklet explaining the use of a lithium chloride solution as a dehumidifier in air conditioning systems. Diagrams various arrangements of the dehumidifying unit.

119. Chemicals. Central Soya Co., Inc., Fort Wayne, Ind.—4-page folder describing Lecithin made by this company from soybean oil. Gives the properties and uses of the chemical.

120. Furnace Linings. The Babcock & Wilcox Co., New York, N. Y.—Bulletin 3-404. 12-page reprint called "Heat Losses in Furnace Linings." Contains graphs and tables to facilitate determination of heat loss through furnace linings.

121. Equipment. Link-Belt Co., Chicago, Ill.—68-page booklet describing the sizes and types of enclosed herringbone gear units for speed reducing and speed increasing service. Includes reducer selection data, examples of proper application, dimensions and horsepower ratings, lubrication data and tables of maximum allowable pull on high and low speed shafts.

122. Instruments. The Gaertner Scientific Corp., Chicago, Ill.—Bulletin 151-74. 8-page booklet discusses the large two-lens quartz spectrograph made by this company. Describes and illustrates the major features of the instrument and its accessories.

123. Centrifugal Pumps. Byron Jackson Co., Los Angeles, Calif.—Bulletin No. 47-7030. 12-page booklet covering many of this company's pumps used in modern mining operations. Includes illustrations of the pumps and installation photographs. Contains capacities and head data for each.

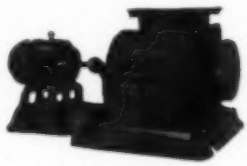
124. Rubber Matting. The B. F. Goodrich Co., Akron, Ohio.—8-page catalog on the line of rubber mats and matting made by this company. Discusses construction and specifications for the different types of product.

125. Coated Fabrics. E. I. du Pont de Nemours and Co., New York, N. Y.—Describes this company's various types of coated fabrics engineered for upholstery. Three lines are included: vinyl plastic, pyroxylin, and rubber coated fabrics.

126. Equipment. Emerson - Scheuring Tank & Manufacturing Co., Inc., Indianapolis, Ind.—4-page folder discusses this

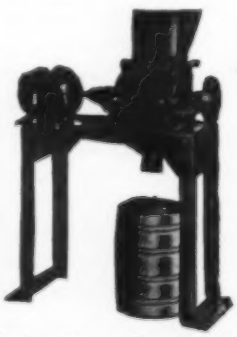
AMERICANS—to Fit Every Crushing Job

From laboratory grinding of samples for analysis—to tonnage crushing of fibrous or friable materials for production there's an AMERICAN CRUSHER to do your particular job *better*. Capacities from pounds to 500 tons per hour . . . with rolling or shredder rings, regular or special hammers for the exact reducing action needed.



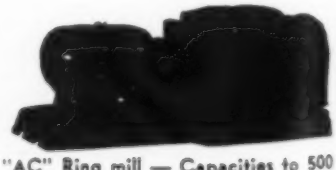
"24" Series—ring or hammer crushers — Capacities to 50 TPH.

"30" Series Hammermill — Capacities to 100 TPH.



Laboratory mill — for testing, pilot plant operation or crushing of waste materials for disposal.

American plastics scrap grinder—for reducing thermoplastics sprues and rejects. Cap. to 450 lbs. per hr.



"AC" Ring mill — Capacities to 500 TPH. Fitted with American's exclusive shredder rings for high tonnage reduction.

Write about your crushing problems or send samples of material.

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1219 Macklind Ave. St. Louis 10, Mo.

FROM THIS UNIFORM WALL TUBING . . .
This piece of plain tubing was formed from a sheet having uniform thickness within ±.0005" . . . The seam fusing the edges of the sheet into a tube is *stronger than the sheet itself*, and as workable in every respect. Here is the uniformly high-strength tubing used to make Rex-Weld Flexible Metal Hose from bronze, steel, stainless steel and other alloys.
± .0005
REX-WELD IS FORMED ON A "50-50" BASIS
Rex-Weld corrugations are formed on the exclusive CMH "50-50" basis—each corrugation is half-formed on each side of the plain tube diameter, instead of being fully formed outward or inward. This reduces stresses in the tubing and produces corrugations having *uniform* wall thicknesses within each corrugation, and in relation to one another.
FLEXONICS ✱ TECHNICAL DATA

. . . to maintain UNIFORM Strength . . . in your FLEXIBLE METAL HOSE!

You can be sure that each type of Rex-Weld Flexible Metal Hose will give full service value within its rating because *there is no guesswork* in the construction of this multi-purpose hose . . . Every operation—from original design to final inspection—is performed within known factors of material strength and flexibility.

Uniformity of wall thickness in Rex-Weld hose allows exact evaluation of its service ability in your plant . . . There are no thin spots or undetected strains to bring early and unexpected failures in service . . . and the exclusive CMH method of forming corrugations provides full flexibility and high resistance to metal fatigue without weakening the basic tubing.

Full data on the many different types of Rex-Weld Flexible Metal Hose in sizes from 3/16" to 12" I. D. and lengths to fit your needs is available. Write for it today.

Some Plain Facts on Metal Tubing . . . Flexible and Otherwise

All CMH Rex-Weld Flexible Metal Hose is made from tubing formed out of flat strips of the various metals used, and is seam-welded at the strip edges to produce a tube of uniform strength, thickness and flexibility. There are a number of reasons for using this type of tubing as a basis for Rex-Weld; *but most important is that only in this way is it possible to be sure of uniform wall thickness in the finished product.* Other methods of manufacture cannot—as yet—hold tubing to nearly as close tolerances as the rolled strip from which Rex-Weld is made.

- Laboratory tests show that when Rex-Weld samples are subjected to abnormally elevated pressures, failure of the tubing occurs at undeterminable points anywhere in the tube.
- CMH choice of seam-welded strip is solely on the basis of findings of its superiority for use in top quality flexible metal hose.

"the science of FLEXONICS . . . "the controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion" . . . is exemplified in the basic products of Chicago Metal Hose Corporation.

CMH

"FLEXON" *identifies CMH products, which have served industry for more than 45 years.*

CHICAGO METAL HOSE CORPORATION

Maywood, Illinois

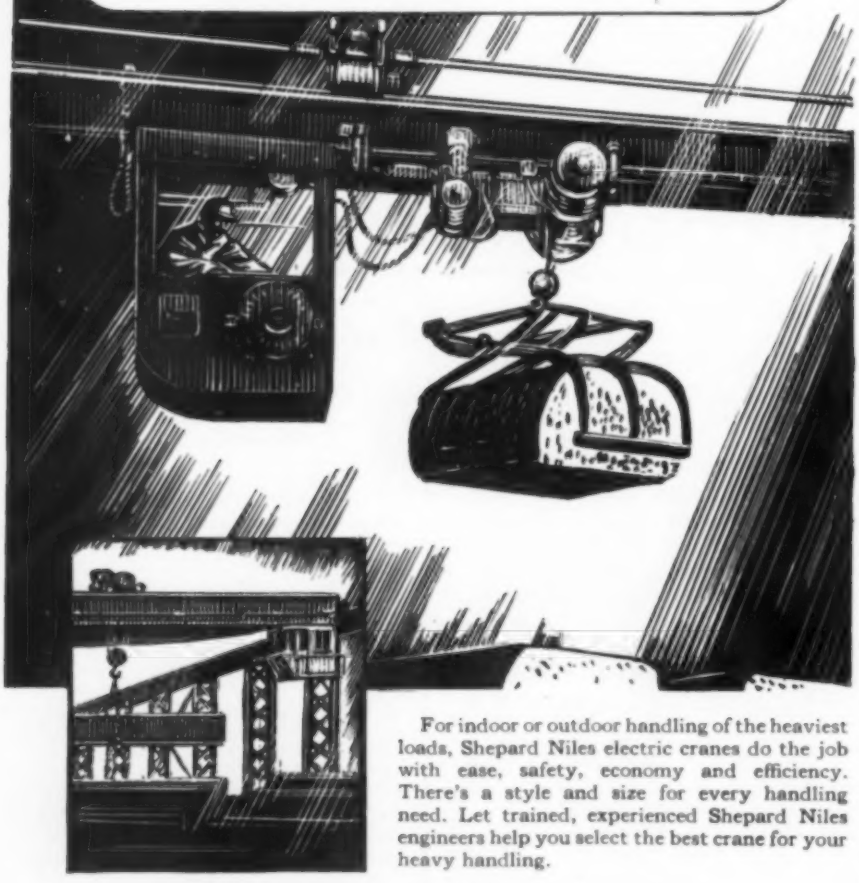
Plants at Maywood and Elgin, Illinois

Need A Railroad In Your Plant?

When you install a Shepard Niles monorail hoist you have your own private railroad to lift heavy loads, move them to other parts of the plant and deposit them where needed.

America's oldest builder of electric hoists and cranes has a style and size of monorail hoist for every handling operation from ⅛ to 20 tons. Trained, experienced Shepard Niles engineers will gladly survey your material handling problems and recommend, without obligation, the best style of monorail hoist to do the job. With over 5,000 styles and sizes from which to choose, there's bound to be one to suit you.

Shepard Niles monorail hoists, whether floor or cab operated, work economically and efficiently, year after year. When a Shepard Niles does the work there's no tired muscles, no absenteeism.



For indoor or outdoor handling of the heaviest loads, Shepard Niles electric cranes do the job with ease, safety, economy and efficiency. There's a style and size for every handling need. Let trained, experienced Shepard Niles engineers help you select the best crane for your heavy handling.

Shepard Niles
CRANE & HOIST CORPORATION
382 SCHUYLER AVE., MONTOUR FALLS, N. Y.

company's tanks, processing and special equipment in steel, stainless steels, pure nickel, aluminum, Monel, Everdur, Inconel and other alloys.

127. Hydrocarbon Thermodynamics. Clark Bros. Co., Inc., Olean, New York.—14-page reprint entitled "Tentative Partial Enthalpies of the Lighter Hydrocarbons". Much of the information is given concisely in tabular form.

128. Materials Handling. Hyster Co., Portland, Ore.—4-page leaflet pictures and diagrams the line of lift trucks, straddle trucks and mobile cranes manufactured by this company. Contains tables giving dimensions, load capacities, weights and engineering data for each model.

129. Insecticide. Julius Hyman & Co., Denver Col.—4-page leaflet discusses various methods of controlling ants with this company's product, Chlordane.

130. Materials Handling. Magnesium Co. of America, Chicago, Ill.—Describes and illustrates this company's magnesium dockboards. Explains their construction and suggests uses.

131. Equipment. The Reliance Electric & Engineering Co., Cleveland, Ohio.—Bulletin 311-A. 4-page flyer covering this company's all-electric adjustable speed drives in the higher horsepower ratings.

132. Paint Ingredient. Witco Chemical Co., New York, N. Y.—2-page technical service report on Witcarb R, a precipitated calcium carbonate said to increase hiding power of paint.

133. Fire Extinguishers. The B. F. Goodrich Co., Akron, Ohio—4-page catalog describing the line of hand operated carbon dioxide fire extinguishers made by this company. Lists the specifications and the replaceable parts for the various models.

134. Thermoplastic. Tennessee Eastman Corp., Kingsport, Tenn.—32-page booklet pictures and describes the uses of this company's three cellulose ester thermoplastics. The properties and manufacture of the material are also discussed. Also available are a 2-page price list and leaflets giving specifications.

135. Chemicals. Harshaw Chemical Co., Cleveland, Ohio.—4-page flyer listing the fluorinating agents produced by this company. Also describes the construction and operation of their fluorinating cell.

136. High Vacuum Pumps. Beach-Russ Co., New York, N. Y.—16-page booklet discussing the design features and operating principles of this company's line of high vacuum pumps. Diagrams in detail their pumps for dry vacuum and for moist vacuum. Contains a graph for determining pump size. Includes specifications, capacities and dimensions.

137. Instruments. Yarnall-Waring Co., Chestnut Hill, Philadelphia 18, Pa.—Bulletin WG-1822. 16-page booklet illustrates and describes the construction and installation details of the remote liquid level indicator made by this company. Contains a page of diagrams showing how the control unit is installed.

138. Equipment. Clark Tructractor, Battle Creek, Mich.—16-page booklet illustrating 14 suggestions by the maker for the application of the Trucloader, a small tractor-like truck with an attached loading device.

139. Aluminum. Permanente Products Co., Kaiser Bldg., Oakland, Calif. 12-page booklet discussing briefly and illustrating this firm's activities in the production and fabrication of aluminum. Gives capacities of the four major plants.

140. Conveyor System. Food Machinery Corp., Riverside, Calif. 8-page bulletin describing the new "Unitized" portable power conveyor system developed by this firm which features a combination power unit and piling conveyor. The basic power unit, combined with various accessories, is used in conjunction with the FMC "Accordian" gravity-type conveyor units to give ruggedness and extreme flexibility. Well illustrated with diagrammatic drawings and photographic reproductions.

CHEMICAL ECONOMICS

H. M. Batters, MARKET EDITOR

CHEMICAL INDUSTRY MOVED INTO FINAL QUARTER OF YEAR WITH A RISE IN OPERATIONAL RATES

FOLLOWING a moderate let-down in the third quarter, manufacturers of chemicals stepped up activities in October and it is expected the current rate of operations will be maintained over the remainder of the year. There are, of course, exceptions in some branches—production of certain agricultural chemicals, for instance—where seasonal influences are operating more normally. In general, however, principal consuming industries are calling for larger deliveries of raw materials and production is keyed accordingly.

Last month considerable publicity was given to an analysis of the overall business situation which concluded that the rise in national output this year was due to the establishment of higher prices and not to any gain in physical volume. This analysis was based on a check of the Federal Reserve Board's indexes for industrial production together with price correctives applied to the estimates of manufacturers' sales as made by the Department of Commerce.

In view of the rising price trend this year it is apparent that comparisons of production or sales figures when made on a dollar basis, cannot be regarded as representative of changes in physical outputs. In the case of chemicals, however, production data are available monthly for such a large part of the industry that accurate quantitative comparisons are possible. Reference to these production data furnishes convincing proof that the output of chemicals this year has been running well ahead of the totals reported for 1946.

Sulphuric acid, which is the ranking tonnage chemical, was produced in the amount of 6,520,563 tons in the first eight months of this year. At present, consuming demand is moving upward. New capacity recently came into operation and a further addition is expected to be made this month. Hence it is probable that total production this year will be approximately 9,850,000 tons. For 1946, production was reported as 8,658,555 tons so the indicated increase for this year is not far from 1,200,000 tons. Other mineral acids are following this production pattern. Indicated output of nitric acid this year is 750,000 tons or about 175,000 tons more than was turned out last year. The rise in production of chlorinated products is pushing outputs of hydrochloric acid to a point where they will top 400,000 tons this year, a gain of at least 60,000 tons over the 1946 total.

Soda ash, which is the second ranking chemical, has been in short supply throughout the year and producers have been under pressure which has prevented complete rehabilitation of over-worked equipment. Production of ash in the first eight months was 3,175,294 tons of which 180,240 tons was the natural product. Incidentally, production of natural ash in August exceeded 27,000 tons with a new producer making its initial contribution. Projecting total ash production through December, gives a probable total of close to 4,800,000 tons or about 300,000 tons more than the figure for 1946.

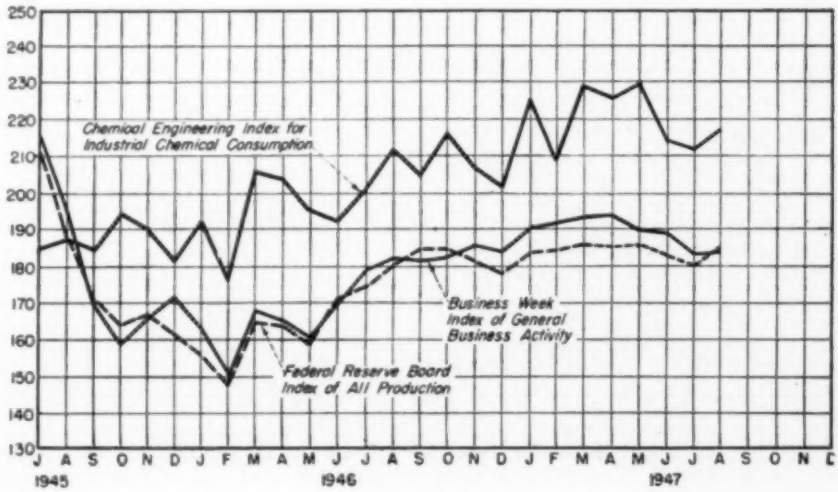
The supply of caustic soda, while inadequate, has been helped by the transfer of government plants to private operation. Lime-soda producers held very close to their 1946 schedules but a new high will be reached this year by electrolytic caustic, bringing production of all grades close to 2,100,000 tons or more than 220,000 tons more than was available last year. Other sodium salts for which appreciable gains over last year are probable include salt cake, silicate and phosphates, although the rate of change within the phosphate group is by no means uniform.

Early in October the Tariff Commission released its preliminary report on production of synthetic organic chemicals for 1946. Current production data cover only a relatively small section of this branch so complete comparison is not yet possible. But they include those most commonly used and in the majority of cases outputs have been running considerably above the 1946 levels. The rise in production of crude coal-tar this year is not correspondingly shown in the volume of crudes and intermediates for more tar is now used for fuel.

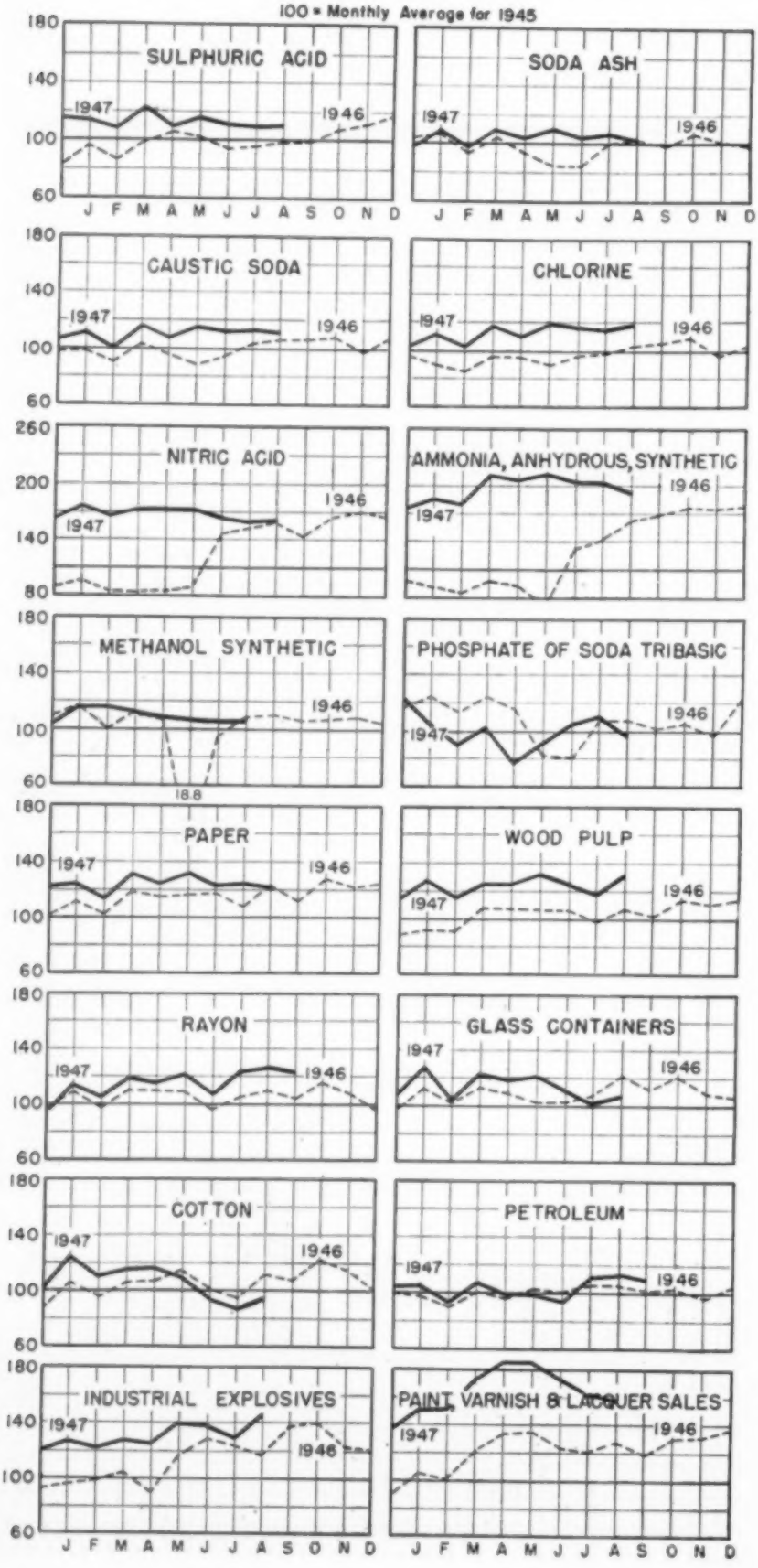
***Chemical Engineering* Index**
Industrial Consumption of Chemicals

1935 = 100

	July Revised	Aug.
Fertilizers	47.95	47.92
Pulp and paper	21.27	22.62
Petroleum refining	20.93	21.00
Glass	20.06	21.48
Paint and varnish	24.30	23.14
Iron and steel	12.16	13.30
Rayon	23.99	22.78
Textiles	9.70	10.22
Coal products	9.85	10.43
Leather	4.60	4.70
Explosives	6.90	7.79
Rubber	5.05	5.45
Plastics	6.14	6.40
	212.90	217.23



PRODUCTION AND CONSUMPTION TRENDS



WITH the exception of fertilizer nitrogen, this country should be able to meet all expected domestic and export requirements for chemicals by the middle of next year. This is the finding set forth in a report made by Secretary Krug's Committee on National Resources and Foreign Aid. This report is of interest because it attempts to chart in definite terms, a five-year production and consumption trend for important segments of the domestic chemical industry. The present position is described as transitional with some chemicals still in short supply, although generally in better condition than in 1946.

Referring to chemical nitrogen, the report places domestic production this year at 1,400,000 tons with Ordnance plants contributing 350,000 tons of the total. For 1950-52, our average production is estimated at 1,400,000 tons and our average consuming requirements are given as 970,000 tons for agriculture and 430,000 tons for industry. These figures compare with 1947 requirements of 800,000 tons for agriculture and 360,000 tons for industry.

The position of soda ash this year is represented by an estimated production figure of 4,700,000 tons with 10,000 tons imported. Domestic requirements of 5,000,000 tons thus indicate a deficit of 290,000 tons. For 1948, production is estimated at 5,200,000 tons with requirements at the same level. Average production for 1949-52 is given as 5,700,000 tons which again is in balance with domestic requirements with no surplus for export.

Caustic soda produced this year, estimated at 2,000,000 tons, falls 199,000 tons short of filling domestic requirements. A rise of 400,000 tons is projected for 1948 which would cover domestic needs and leave a surplus of 100,000 tons. Average production for 1949-52 is expected to reach 2,800,000 tons which is 200,000 tons more than estimated requirements.

Reversing the general trend, the report forecasts a downward movement in both production and consumption of carbon black. The estimate for 1947 production is 1,270 million pounds with home requirements placed at a billion pounds. For 1948, probable production is dropped to 1,100 million pounds with another drop of 100 million pounds credited as the average for 1949-52. Domestic requirements also are dropped to 810 million pounds for 1948 and to 735 million for the 1949-52 average.

CHEMICO
CHEMICAL CONSTRUCTION CORP.

Look to this "seal of certainty" for

ACID RECOVERY

. . . PRODUCTION

. . . CONCENTRATION

A contract with CHEMICO is a *certainty* because CHEMICO guarantees the performance of its plants and processes as part of their contract. CHEMICO can predict plant performance with *certainty* because of the knowledge and experience gained in designing and constructing over 600 installations throughout the world.

CHEMICO's complete service for the production, recovery or concentration of sulphuric acid or other acids embraces every element, including the development of new processes when necessary . . . the design and construction of plants . . . the installation of equipment . . . and initial training of the operating staff. Look to CHEMICO for authoritative assistance in acid production.

"Chemico plants are profitable investments"

CHEMICAL CONSTRUCTION CORPORATION

EMPIRE STATE BLDG., 350 FIFTH AVE., NEW YORK 1, N. Y.

European Technical Repr.: Cyanamid Products, Ltd., Bretton[illegible]

TERRISS SEAMLESS STAINLESS STEELWARE

PAIL with pouring Lip, handle and bail

24 QT. COVERED BATCH CAN

COVERED UTILITY JAR in 2 qt. and 4 qt. sizes

PAIL in 10, 12 15 and 20 qt. sizes

Shipment from stock

We can supply Stainless Steel graduated measures, basins, pans, trays, beakers, etc.

CONSOLIDATED SIPHON SUPPLY CO., INC.
DEPT. C. 22-24 Wooster St. New York City

United States Producton of Certain Chemicals

August 1947, August 1946 and Eight-Month Totals for 1947 and 1946

Chemical (Tons unless otherwise noted)	August 1947	August 1946	Total, Eight Months 1947	Total, Eight Months 1946
Ammonia, synthetic, anhydrous[1]	88,807	75,794	727,560	404,71
Ammonium nitrate (100% NH_4NO_3)	53,102	77,638	696,958	382,119
Ammonium sulphate, synthetic, technical (M lb.)	30,085	17,183	256,719	192,026
Calcium arsenate ($Ca_3(AsO_4)_2$) (M lb.)	4,325	8,081	38,429	39,784
Calcium carbide, commercial	50,827	53,399	409,019	351,982
Calcium phosphate: (M lb.)				
Monobasic (100% $CaH_4(PO_4)_2$)	6,738	8,091	46,743	46,355
Dibasic (100% $CaHPO_4$)	4,432	6,059	48,484	32,630
Carbon dioxide:				
Liquid and gas (M lb.)	27,130	24,279	163,921	146,917
Solid (M lb.)	80,516	72,292	501,278	442,512
Chlorine	118,497	102,550	906,837	752,983
Chrome green (M lb.)	931	1,436	9,098	12,847
Chrome yellow and orange (M lb.)	3,424	3,410	31,600	30,807
Hydrochloric acid (100% HCl)	34,599	29,519	278,886	218,539
Hydrogen (M cu. ft.)	1,901,000	1,675,000	13,556,000	11,419,000
Lead arsenate, acid and basic (M lb.)	.....	253	.....	45,193
Molybdate chrome orange	287	443	2,822	3,439
Nitric acid (100% HNO_3)	60,387	59,144	502,770	332,278
Oxygen (M cu. ft.)	1,104,000	1,008,000	8,922,000	6,775,000
Phosphoric acid (50% H_3PO_4)	88,083	74,574	672,187	578,349
Soda ash:				
Ammonia-soda process:				
Total wet and dry[2]	363,890	364,178	2,994,054	3,889,906
Finished light[3]	177,467	167,983	1,452,334	1,359,445
Finished dense	132,186	139,678	1,089,901	996,353
Natural[4]	27,294	18,338	180,240	138,910
Sodium bicarbonate, refined	14,300	17,054	134,206	124,566
Sodium bichromate and chromate	7,219	7,254	56,901	69,092
Sodium hydroxide:				
Electrolytic process:				
Liquid[5]	116,697	99,870	883,177	730,933
Solid	19,118	18,145	153,885	127,907
Lime soda process:				
Liquid[5]	60,613	63,745	504,159	491,334
Solid	21,409	20,504	164,395	145,339
Sodium phosphate:				
Monobasic (100% NaH_2PO_4)	1,153	1,218	9,509	7,795
Dibasic (100% Na_2HPO_4)	7,281	5,103	52,057	38,182
Tribasic (100% Na_3PO_4)	7,344	7,958	57,760	63,386
Meta (100% $NaPO_3$)	2,692	2,373	20,093	17,323
Tetra (100% $Na_4P_2O_7$)	5,154	4,778	35,084	35,413
Sodium silicate, anhydrous	33,983	36,915	311,359	267,499
Sodium sulphate:				
Anhydrous, refined	10,628	10,285	91,364	83,793
Glauber's salt[3]	13,813	13,209	130,918	108,351
Salt cake, crude, commercial[3]	52,129	43,779	414,331	348,147
Sulphuric acid:[7]				
Chamber process	258,796	237,916	2,188,892	2,062,460
Contact process, new	544,013	465,859	4,381,871	3,590,777
Zinc yellow (zinc chromate) (C.P.)	323	216	2,180	.....

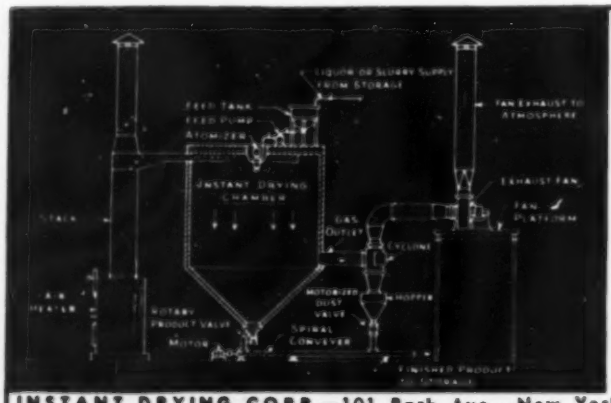
Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census. Production figures represent primary production and do not include purchased or transferred materials. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given data are either confidential or not yet available. [1]Includes a small amount of aqua ammonia. [2]Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finished light and finished dense. [3]Not including quantities converted to finished dense. [4]Data collected in cooperation with the Bureau of Mines. [5]Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6]Includes oleum grades, excludes spent acid. [7]Data for suphuric acid manufactured as a byproduct of smelting operations are included.

United States Production of Certain Synthetic Organic Chemicals

July 1947, July 1946 and Seven-Month Totals for 1947 and 1946

Chemical	July 1947	July 1946	Total, Seven Months 1947	Total, Seven Months 1946
Acetanilid, technical and U.S.P.	563,089	.....	4,832,382	.....
Acetic acid:				
Synthetic[1]	33,193,826	23,907,485	216,355,778	157,243,691
Recovered	121,831,729	99,522,121	824,463,218	671,431,383
Natural[2]	2,222,002	2,423,495	14,490,696	15,226,625
Acetic anhydride[3]	52,910,218	44,520,734	350,703,832	300,703,919

(*Continued on page 286*)



LOW COST DRYING
with the
"INSTANT DRYING" SYSTEM

- Less power needed
- Trouble free
- Large capacity
- Rugged construction
- Minimum labor cost

Many industries have proved savings. Write to us on your drying problem.

INSTANT DRYING CORP.—101 Park Ave., New York 17, N. Y.
Testing laboratories, Poughkeepsie, N. Y.—Eng. by Clark, MacMullen and Riley, Inc., New York

Wherever you are . . . whatever your needs, let Amsco analyze your solvent problems

Perhaps you desire more economy and speed in your operation.

Perhaps you want more safety, flexibility, or greater speed of solvent release.

Maybe you demand more rapid delivery.

Whatever your need, Amsco is enthusiastic and ready to help.

If one of our long line of versatile solvents will not fit your requirements, we will go to work on a new product specifically designed for you.

Here are a few reasons why, after a quarter of a century, Amsco solvents are continuing to serve an ever-increasing share of American industry:

- *—Choice of volatility. From fast-evaporating Pentane to slow-drying, high-boiling solvents.*
- *—Choice of solvency. From pure paraffins to pure aromatics plus materials of intermediate solvency.*
- *—Any desired boiling range. From 5° F. upward in some fractions.*
- *—High degree of purity. Good odor and constant continuity of specifications.*
- *—Amsco's famous "Service that goes beyond the sale."*

Let us tell you more about what Amsco products and services can do for you. Just mail this coupon today for full details.

THE MOST COMPLETE LINE OF PETROLEUM BASE SOLVENTS AVAILABLE

Amsco products constitute the widest variety of petroleum solvents available. Every one of them, from oldest to newest, must measure up to the company's 25-year reputation—a reputation for uniform high quality, for prompt service and for an eagerness to develop new products to meet industry's ever-changing demands.

AMERICAN MINERAL SPIRITS COMPANY
Chicago, New York

LOS ANGELES • PHILADELPHIA • DETROIT • CLEVELAND • MILWAUKEE • INDIANAPOLIS • CINCINNATI • HOUSTON
NEW ORLEANS • ATLANTA • BUFFALO • BOSTON • PROVIDENCE • CORPUS CHRISTI • TORONTO • MONTREAL

American Mineral Spirits Company, Dept. CE-5
230 North Michigan Avenue
Chicago 1, Illinois

Please send information on the complete line of Amsco petroleum-base solvents to:

Name.....Position .....

Company.....

Street Address.....

City and State.....

(Samples sent on request)

Now... Fibrous Silica Batt and Cloth

REFRASIL

originally developed for aircraft jet insulation now offers to the Chemical Industries the following unusual properties:

- WITHSTANDS 2000° F. INDEFINITELY
  up to 500° F. higher for short periods — fuses at approx. 3100°F.
- CHEMICAL RESISTANCE
  —not affected by most commercial acids—does not combine with usual components of high temperature alloys even on long contact at 2000°F.
- EXTREMELY LIGHT WEIGHT:
  Surface density approx. .05 lbs. per sq. ft. of approx. 3/16" thickness. Bulk density, approx. 4 lbs. per cu. ft.
- FIBER DIAMETER
  0.00023 inches, average.
- RESISTANCE TO VIBRATION:
  Not seriously affected by extreme high frequency, high amplitude vibration of aircraft jet motor tail pipes.
- THERMAL CONDUCTIVITY:
  (graph on request)—at low temperatures — approx. ⅓ thermal conductivity of standard insulating materials. At 2000° FA.—by far the lowest of all materials available.
- AVAILABLE FORMS:
  Batt in rolls approx. 14' long by 3½ wide by 3/16" thick. *Cloth* in rolls of random lengths approx. 32" wide by 0.015" thick. Tapes, sleevings, and cordage of various widths and lengths. Loose fibers in bulk. Also, insulating blankets fully prefabricated by us to specification, either permanent or removable.

FOR ENGINEERING COOPERATION ON ANY APPLICATION WRITE

THE H. I. THOMPSON CO.

Section 14-11, 1733 Cordova St.

Los Angeles 7, Calif.

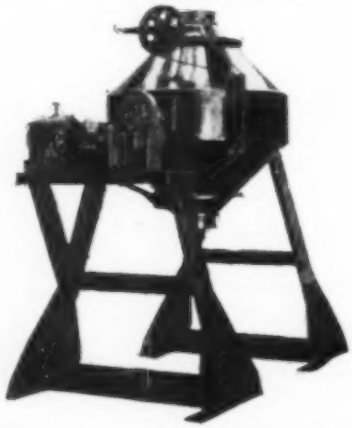
U. S. Production of Synthetic Organic Chemicals (Cont. from page 284)

Chemical	July 1947	July 1946	Total, Seven Months 1947	Total, Seven Months 1946
Acetone	39,137,918	24,666,012	223,976,863	185,447,727
Acetylsalicylic acid	995,332	572,337	7,029,901	6,133,980
Aniline	6,240,582	8,213,302	61,253,321	49,630,831
5-Ethyl-5-phenylbarbituric acid and salts (Phenobarbital)[2]	44,781	38,331	265,109	233,715
Benzene:				
Motor grade:				
Tar distillers[4]	.....	502,580	.....	5,878,385
Coke-oven operators[5]	1,318,764	3,082,148	12,254,988	16,862,803
All other grades:				
Tar distillers[4]	1,502,568	1,381,563	12,191,761	13,485,969
Coke oven operators[5]	10,940,432	9,714,294	83,593,232	53,153,584
Butyl alcohol, normal, primary	11,847,240	11,013,282	74,035,938	61,031,675
Carbon bisulphide	28,210,960	23,360,877	201,008,086	169,962,214
Carbon tetrachloride	15,784,934	10,674,553	115,417,994	79,184,839
Chlorobenzene, mono	29,064,218	20,887,731	187,494,136	154,936,926
Creosote oil:				
Tar distillers[4]	8,601,387	8,650,252	72,673,185	63,575,664
Coke-oven operators[5]	3,018,221	2,529,843	21,766,328	13,243,682
Cresols:				
Meta-para	601,989	836,391	3,532,499	2,602,862
Ortho-meta-para	827,222	1,063,308	5,613,749	.....
Cresylic acid, refined[7, 10]	2,328,681	2,180,642	15,339,668	12,470,554
Dibutyl phthalate	1,845,772	1,118,944	12,576,058	.....
Dichlorodiphenyltrichloroethane (DDT)	4,962,453	3,573,122	31,961,802	25,426,428
Ethyl acetate (85%)	5,584,579	9,877,090	49,654,197	51,792,285
Ethylene glycol	19,923,468	.....	115,421,118	.....
Ethyl ether	3,409,046	3,448,050	25,464,786	23,704,437
Formaldehyde (37% by wt.)	40,884,258	38,094,994	309,947,413	262,404,221
Hexachlorocyclohexane	569,099	.....	2,486,185	.....
Methanol:				
Natural[8]	1,170,008	1,326,054	9,354,897	9,193,597
Synthetic	45,015,671	44,841,123	313,293,825	271,267,700
Naphthalene:				
Tar distillers, less than 79° C.[4]	18,685,204	17,505,571	125,782,386	102,709,008
Tar distillers, 79° C. and over[4]	9,075,254	7,372,423	70,625,779	55,726,247
Coke-oven operators, less than 79° C.[5]	8,064,038	7,320,652	54,478,629	33,522,590
Penicillin[3]	2,678,837	2,292,287	19,944,045	14,783,755
Phenol, synthetic and natural	24,701,138	13,492,879	147,842,604	114,317,441
Phthalic anhydride	12,871,071	8,921,278	78,990,421	60,037,291
Styrene, government and private owned plants	18,895,273	32,835,374	181,241,927	216,803,308
Toluene, coke-oven operators	2,054,418	1,392,681	25,061,431	9,244,530
Toluene, all other[9]	3,591,885	1,050,287	17,383,089	7,625,111
Xylene, crude, from coal-tar and petroleum	2,179,534	.....	25,995,727	.....

All data in pounds except benzene (gal.) creosote oil (gal.), toluene (gal.) xylene (gal.) and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [1]Excludes the statistics on recovered acid. [2]Acid produced by direct process from wood and from calcium acetate. [3]All acetic anhydride including that from acetic by vapor-phase process. [4]Product of distillers who use purchased coal tar only or from oil-gas or water-gas produced or purchased by tar distillers. [5]Statistics are given in terms of bulk medicinals only. [6]Statistics collected by Bureau of Mines. [7]Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8]Reported to U. S. Bureau of the Census. [9]Includes toluene produced from petroleum by any process. [10]Includes refined cresylic acid from petroleum.

Patented "GEMCO" CONICAL BLENDER

Laboratory To 50 barrel capacities:



Blends are satisfactorily obtained in six minutes.

The "Gemco" Conical Blender is in service by many prominent concerns including:

American Brake Shoe Co.
Arkansas Company, Inc.
The Eagle-Picher Co.
Firestone Tire & Rubber Co.
Harmon Color Works, Inc.
Imperial Paper & Color Corp.
Charles Lennig & Co., Inc.
Rohm & Haas Company,
The Sherwin-Williams Co.
U. S. Metals Refining Co.
World Bestos Corp.

HAS BEEN DEVELOPED

for blending dry granular, or soft attractive materials. It does a quiet, quick, low power consuming job. Custom built to conform with user's requirements, expertly engineered and machined. The conical shape of the blender and valve construction permit a 100% emptying and DUSTLESS operation. The valve is a "Gemco" spherical valve which is dust-tite and non-sticking; and can be operated from the floor regardless of blender's position. Blender shells are supported by ball or roller bearing pillow blocks, and are driven through quiet, totally enclosed worm gear reducers connected with flexible couplings to motor. Solenoid operated brake with inching device permits operator to stop blender accurately in any position.

We can furnish additional devices which, when incorporated in our blender can:

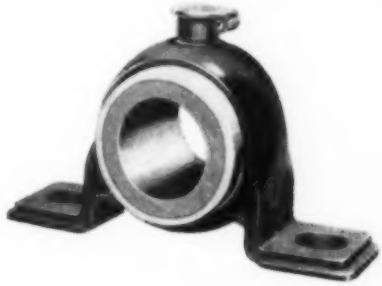
1.—Maintain particle size.
2.—Disperse material which has a tendency to lump.
3.—Rub out material while blending.
4.—Maintain required temperature.

The exclusive right to manufacture, vend and PROTECT our customers IN THE USE OF the "GEMCO" Conical Blender, has been granted us under Letters Patent No. 2,018,082 and No. 2,108,502.

GENERAL MACHINE COMPANY OF N. J.

Established 1916

400 Market Street, Newark, N. J.

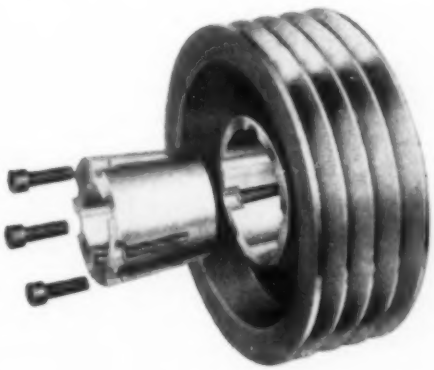


This is the BRONZOIL Bearing. Developed by Dodge for fan and blower service. A new and better transmission appliance.

U. S. Patent No. 1,931,055

This is the ROLLING GRIP Clutch. Developed by Dodge. No toggles. A new and better transmission appliance.

U. S. Patent No. 2,397,414



This is the TAPER-LOCK Sheave. Developed by Dodge. No flange. No collar. A new and better transmission appliance.

U. S. Patent No. 2,402,743

This is the Dodge Transmissioneer – who will tell you about new ways of transmitting power mechanically.

DODGE

of Mishawaka, Ind.

New equipment which helps cut costs, improve machine performance, increase production is offered to you by Dodge of Mishawaka. For detailed information about power transmission units to meet specific needs in your plant, or on your product, call the Transmissioneer, your local Dodge distributor. Look for his name in the classified telephone directory under "Power Transmission Equipment." A talk with him will prove profitable to you.

DODGE MANUFACTURING CORP., MISHAWAKA, IND.

Copyright, 1947, Dodge Mfg. Corp.

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

Factory Production and Consumption of Fats and Oils in the West, 1946*

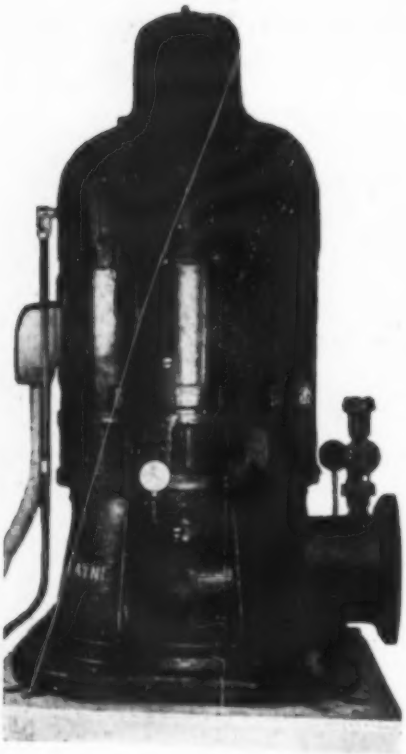
(In thousands of pounds)

Item	Factory Production 1946	Factory Consumption 1946	Stocks: Factory and Warehouse Dec. 31, 1946
Vegetable Oils			
Cottonseed, crude	70,923	84,092	7,482
Cottonseed, refined	78,108	128,666	8,458
Peanut, crude	†	801	140
Peanut, refined	853	7,374	570
Coconut, crude	272,785	42,038	39,759
Coconut, refined	19,408	12,936	1,248
Corn, refined	269	476	118
Soybean, crude	36,636	91,120	6,987
Soybean, refined	84,844	94,151	4,333
Olive, edible	2,306	5	228
Linseed	50,642	48,952	19,574
China wood or tung	.....	3,255	2,641
Oiticica	.....	1,256	225
All other	12,781	12,063	1,992
Animal Fats			
Lard, rendered, including neutral lard and rendered pork fat	65,284	3,117	5,916
Tallow, edible	13,297	8,598	884
Tallow, inedible	140,551	140,347	15,454
Neat's-foot oil	70	10	18
Greases			
Greases (including garbage and house), other than wool	23,290	17,111	2,204
Wool grease	.....	324	165
Other Products			
Glycerin, crude (100% basis)	13,834	12,630	1,403
Glycerin, high gravity and yellow distilled (100% basis)	7,332	3,455	1,156
Glycerin, chemically pure (100% basis)	4,076	2,526	422
Hydrogenated oils, edible	138,388	120,458	3,305
Hydrogenated oils, inedible	18,238	9,994	370
Shortening	118,070	252	4,585
Winterized vegetable oils	47,868	.....	1,803

Raw Materials Used, (Tons)

Item	Factory Consumption 1946	Factory Stocks Dec. 31, 1946
Cottonseed	218,908	123,142
Copra	215,805	41,849
Olives	7,294	1,654
Flaxseed	54,279	10,355
Soybeans	96,716	.....
All other	19,744	1,185

* The eleven states included are: Washington, Oregon, California, Idaho, Nevada, Montana, Wyoming, Utah, Arizona, Colorado and New Mexico. †Not shown to avoid disclosure of individual operations. Source: Bureau of the Census



6 MILLION GALLONS DAILY

FOR JANESVILLE, WIS.

Janesville is a mighty lucky city. Their newly installed Layne Water Supply Unit is producing over 6,000,000 gallons daily with enough water on reserve for 16,000,000 gallons daily from the same well. The drawdown beyond the six-million gallons daily is almost negligible. Such a record is greatly attributed to the soundness of Layne's fine engineering and splendid installation methods.

Every Layne Well Water Supply Unit is designed and built to produce the absolute maximum amount of water at a minimum of cost. Many installations exceed the Layne guarantee, thus richly rewarding the buyer for his confidence in the Layne Organization and their proven methods.

If your city, factory, processing plant, railroad or irrigation project needs more water Layne Engineers will gladly provide dependable water development recommendations. No obligation. For literature, address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

LAYNE

WELL WATER SYSTEMS

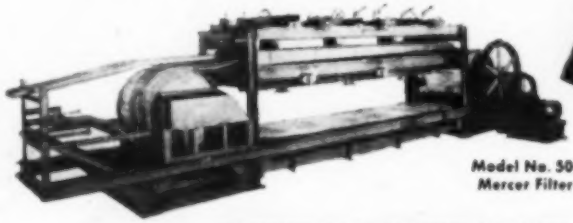
vertical turbine pumps

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. • Layne-Atlantic Co., Norfolk, Va. • Layne-Central Co., Memphis, Tenn. • Layne-Northern Co., Mishawaka, Ind. • Layne-Louisiana Co., Lake Charles, La. • Louisiana Well Co., Monroe, La. • Layne-New York Co., New York City • Layne-Northwest Co., Milwaukee, Wis. • Layne-Ohio Co., Columbus, Ohio • Layne-Pacific, Inc., Seattle, Wash. • Layne-Texas Co., Houston, Texas • Layne-Western Co., Kansas City, Mo. • Layne-Western Co. of Minn., Minneapolis, Minn. • International Water Supply Ltd., London, Ont., Can. • Layne-Hispano Americana, S. A., Mexico, D. F.

MERCER BAND Filters

FILTRATION WASHING DRYING

Low-cost Efficient Continuous Suction Process



Model No. 50 Mercer Filter

PERFORMANCE—PROVEN FEATURES

Multiple washing zones. Evenly formed filtered cake. Varied thicknesses. Automatic cake discharge. Continuous filter medium cleansing. Low power consumption.

WRITE FOR MERCER FILTERS BULLETIN No. 70

Arrange for Test

Mercer plant is equipped to conduct and report upon experimental tests made with samples of your materials. Inquire about this service.

"The Name that Carries Weight"

MERCER ENGINEERING WORKS, INC.

REPRESENTED BY MERCER-ROBINSON COMPANY, INC.

30 CHURCH STREET, NEW YORK 7, N Y.

Sales Offices in Principal Cities

"When you want this valve to work . . . it works"

it's

Stick-Proof

because

it's

LEVER-SEALD

HOMESTEAD LEVER-SEALD VALVES operate *instantly* with only a *Quarter-Turn* . . . at all times and under all conditions . . . in services where extremes of temperature, pressure, or the corrosive action of line fluids would cause ordinary valves to stick or "seize."

That's why they have been favorites with industry for more than 15 years in all sorts of difficult applications.

They're *stick-proof*, because built right into each valve is a powerful lever and screw device that *relieves seating pressure* between plug and body just enough to overcome friction and permit *easy turning*.

This *stick-proof* construction is only one of many HOMESTEAD LEVER-SEALD VALVE features assuring long, economical, trouble-free service.

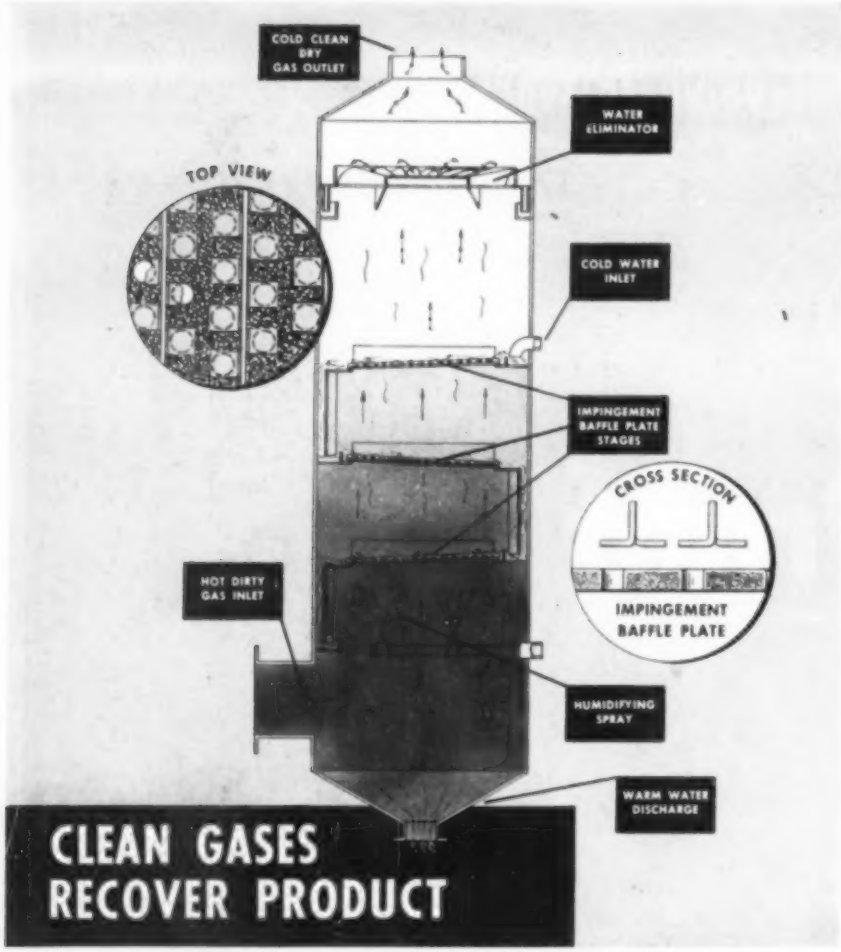
You may order HOMESTEAD LEVER-SEALD VALVES in metals and alloys to meet service requirements, in sizes from 1½" to 12" with regular or wedge gate valve face to face dimensions, for pressures from vacuum to 1500 pounds. Complete technical details and Valve Reference Book No. 38 are yours for the asking.

CHECK THESE OUTSTANDING LEVER-SEALD VALVE FEATURES

1. Instant stick-proof operation.
2. Quarter-turn fully opens or closes.
3. Positive mechanical seal.
4. Seating surfaces always protected in both open and closed positions. Corrosion practically eliminated.
5. Unobstructed straight-line fluid flow.
6. All operating parts protected from damaging effects of service conditions and weather.

HOMESTEAD VALVE MANUFACTURING COMPANY

P. O. BOX 13 CORAOPOLIS, PA.



...with PEABODY SCRUBBERS

PEABODY Scrubbers and Coolers are chosen by leading plant processing engineers because they can *depend* on Peabody to –

- ***Recover solid products, such as carbon from generators, soda ash from kilns, dextrose from packaging and mixing operations, etc.***
- ***Remove entrained solids from gases.***
- ***Cool gases used in processing.***

HOW IT WORKS: Dirt-laden gas, entering at the bottom of the unit, flows through one or more impingement baffle stages where it is divided into many high-velocity jets and is hurled against wetted baffles. Suspended matter carried in the jets is violently thrown out of the gas stream and is washed away by the scrubbing liquid flowing across the baffle stage. The clean gas rises to the next stage and passes through water eliminator to outlet.

Bulletin H-2021 gives further information on Peabody Scrubbers. Consult our Engineering Department for further details without obligation.

S-1

PEABODY
ENGINEERING CORPORATION
580 FIFTH AVENUE • NEW YORK 19, N. Y.
Offices in Principal Cities

CHEMICAL ENGINEERING Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

As of November 1	128.40
Last month (revised)	124.94
November, 1946	112.66
November, 1945	108.78

CURRENT PRICES

The accompanying prices refer to round lots Where it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to November 1.

INDUSTRIAL CHEMICALS

Acetone, tank, lb.	$0.07½ - $0.09
Acid, acetic, 28%, bbl., 100 lb.	3.78 - 4.03
Boric, bbl., ton	124.00 - 142.50
Citric, drums, lb.	.24 - .26
Formic, cbys., lb.	.12 - .14
Hydrofluoric, 30%, drums, lb.	.08 - .085
Lactic, 44% tech., light, bbl., lb.	.0815 - .0855
Muriatic, 18%, tanks, ton	18.00 - .....
Nitric, 36°, carboys, lb.	.05 - .05½
Oleum, tanks, wks., ton	19.50 - 20.00
Oxalic, crystals, bbl., lb.	.13 - .14
Phosphoric tech., tanks, lb.	.04 - .....
Sulphuric, 60°, tanks, ton	13.00 - .....
Tartaric, powd., bbl., lb.	.49½ - .50
Alcohol, amyl from pentane, tanks, lb.	.17 - .....
Alcohol, butyl, tanks, lb.	.17 - .29
Alcohol, ethyl, denatured, No. 1 special tanks, gal.	.96 - .....
Alum, ammonia, lump, lb.	.04½ .....
Aluminum sulphate, com. bags, 100 lb.	1.15 - 1.25
Ammonia, anhydrous, cyl., lb.	.16 - .20
tanks, ton	59.00 - 61.50
Ammonium carbonate, powd., casks, lb.	.09½ - .10
Sulphate, wks., ton	35.00 - 38.00
Amyl acetate, tech. from pentane, tanks, lb.	.21 - .....
Aqua ammonia, 26°, drums, lb.	.03 - .03½
tanks, ton	65.00 - .....
Arsenic, white powd., bbl., lb.	.06 - .07
Barium carbonate, bags, ton	67.50 - 75.00
Chloride, bags, ton	85.00 - 90.00
Nitrate, casks, lb.	.11½ - .12
Blanc fixe, dry, bags, ton	67.50 - 72.50
Bleaching powder, f.o.b., wks., drums, 100 lb.	3.75 - 4.00
Borax, gran., bags, ton	48.50 - 66.00
Calcium acetate, bags, 100 lb.	3.00 - .....
Arsenate, dr., lb.	.09½ - .10
Carbide, drums, ton	70.00 - .....
Chloride, flake, bags, del., ton	21.50 - 38.00
Carbon bisulphide, drums, lb.	.05½ - .06½
Tetrachloride, drums, lb.	.06½ - .07
Chlorine, liquid, tanks, wks., 100 lb.	2.25 - 2.50
Copperas, bgs., f.o.b., wks., ton	17.00 - 18.00
Copper carbonate, bbl., lb.	.24 - .27
Sulphate, bags, 100 lb.	7.60 - 7.75
Cream of tartar, bbl., lb.	.41½ - .42
Diethylene glycol, dr., lb.	.15 - .16
Epsom salt, dom., tech., bbl., 100 lb.	2.05 - 2.25
Ethyl acetate, tanks, lb.	.12 - .16
Formaldehyde, 30%, dr., wks., lb.	.0545 - .....
Furfural, tanks, lb.	.09½ .....
Glaubers salt, bag, 100 lb.	1.25 - 1.50
Glycerine, c.p., drums, extra, lb.	.29½ - .30
Lead:	
White, basic carbonate, dry casks, lb.	.15½ .....
Red, dry, csk., lb.	.176 - .18
Lead acetate, white crys., bbl., lb.	.19½ - .20½
Arsenate, powd., bags, lb.	.21½ - .22
Lithopone, bags, lb.	.06 - .06½
Magnesium carb., tech., bags, lb.	.07½ - .08
Methanol, 95%, tanks, gal.	.60 - .....
Synthetic, tanks, gal.	.24 - .29
Phosphorus, yellow, cases, lb.	.22 - .25
Potassium bichromate, bags, lb.	.11½ - .11½
Chlorate, powd., lb.	.09 - .09½
Hydroxide (c'stic potash) dr., lb.	.0785 - .09½
Muriate, 60%, bags, unit	.37½ - .45½
Nitrate, ref., bbl., lb.	.08½ - .12
Permanganate, drums, lb.	.20½ - .21½
Prussiate, yellow, casks, lb.	.19 - .20
Sal ammoniac, white, casks, 100 lb.	4.75 - 5.00
Salsoda, bbl., 100 lb.	1.10 - 1.20
Salt cake, bulk, ton	20.00 - 25.00
Soda ash, light, 58%, contract, bags, 100 lb.	1.30 - .....
Dense, bags, 100 lb.	1.38 - .....
Soda, caustic, 76% solid, drums, 100 lb.	2.85 - .....
Acetate, del., lb.	.05½ - .06
Bicarbonate, bags, 100 lb.	2.25 - 2.73
Bichromate, bags, lb.	.09 - .09½
Bisulphate, bulk, ton	20.00 - 24.00
Bisulphite, bbl., lb.	.03½ - .04

The economics of TCC... AS APPLIED TO 16 REFINERIES

Here are 16 refineries, located in 9 states and varying in crude capacity from 3,000 BPD to 25,000 BPD. Houdry engineers analyzed the over-all operations of each of these refineries and projected the addition to it of T C C cracking.

The true measure of the earning power of T C C equipment is reflected in the low differential between the by-product cost of gasoline and the cost of crude. The resulting increase in earnings makes it possible for any of these refiners to retire T C C's low capital cost within a relatively short period of time.

Ask Houdry to demonstrate the profits from T C C installation in your refinery.

SUMMARY OF ECONOMICS FOR VARIOUS REFINERY PROJECTS

Refinery Analysis No.	Crude Capacity BPCD	Gasoline BPCD	Distillate Fuels BPCD	Residual Fuel BPCD	ASTM Octane No.	TEL Ccs/Gal.	Crude Cost ¢/Gal.	By-Product Cost of Gasoline ¢/Gal.	Differential ¢/Gal.	Payout in Years
1	5,000	2,893	1,185	688	83.0	1.9	3.8	4.6	0.8	1.4
2	5,000	2,848	600	1,428	83.5	1.3	3.0	5.0	2.0	2.2
3	5,000	3,281	1,239	286	77.5	1.7	4.2	5.1	0.9	3.5
4	3,000	1,206	870	914	79.0	1.3	4.6	4.9	0.3	2.3
5	6,000	3,673	1,080	1,036	77.5	0.7	3.2	4.2	1.0	3.7
6	4,000	2,842	320	604	79.0	0.7	3.2	4.7	1.5	3.6
7	6,000	3,992	.....	1,566	82.5	0.9	3.0	5.1	2.1	2.9
8	4,000	2,610	400	753	78.0	0.5	3.1	4.6	1.5	2.9
9	12,000	7,787	1,800	1,602	81.0	1.5	2.8	4.0	1.2	1.1
10	5,330	3,812	.....	1,032	80.5	0.5	2.9	4.5	1.6	3.3
11	22,500	15,562	2,250	3,004	80.0	0.6	3.9	5.1	1.2	2.3
12	12,000	5,969	1,025	4,612	82.0	1.1	2.5	3.6	1.1	2.5
13	10,000	5,110	3,963	574	78.0	0.5	3.5	3.9	0.4	1.8
14	3,500	1,764	525	1,069	80.0	1.1	3.1	4.7	1.6	2.2
15	9,000	4,663	2,375	1,662	76.0	0.6	4.6	5.1	0.5	2.2
16	6,750	4,473	1,991	783	81.5	1.5	3.9	4.7	0.8	1.7

HOUDRY PROCESS CORPORATION
25 Broad Street, New York 4, N. Y.

HOUDRY CATALYTIC PROCESSES

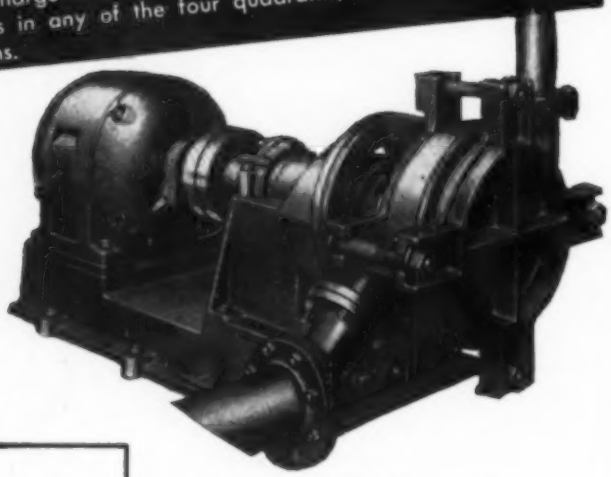
Only the NEW TYPE "R" MORRIS SLURRY PUMP has these 4 FEATURES!

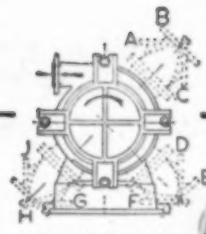
1. The gland is under suction pressure only. This feature practically eliminates packing troubles.

2. For dismantling, you need remove only four bolts. The Type "R" Morris has no internal studs or bolts . . . no troublesome fits or joints.

3. You can remove the impeller and liner without disturbing piping.

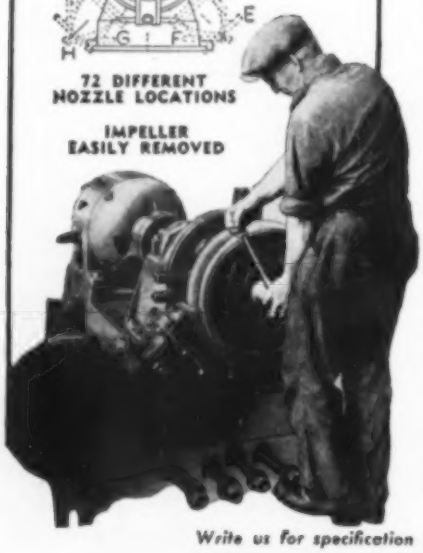
4. Shell interchangeable for right or left hand rotation. Suction and discharge nozzles can be rotated around axis of pump to positions in any of the four quadrants, a total of 72 combinations.





72 DIFFERENT NOZZLE LOCATIONS

IMPELLER EASILY REMOVED



And They Add Up to These EXCLUSIVE ADVANTAGES

- EASY TO INSTALL!
- EASY TO DISMANTLE!
- EASY TO MAINTAIN!

The New Type "R" Morris Pump—the most advanced design in the pump field—is specifically engineered to handle sludges and silt; the moving of all types of caustic or acid mixtures containing abrasives or solids; and mixtures containing ore concentrates, tailings, slag, and the residue from filters and classifiers.

Write us for specification and operation data on pumps best suited to your particular needs. No charge or obligation.

MORRIS MACHINE WORKS, Baldwinsville, N. Y.
Sales Offices in Principal Cities

MORRIS CENTRIFUGAL PUMPS

CHEMICAL ENGINEERING Weighted Index of Prices for OILS & FATS

Base = 100 for 1937

As of November 1	**252.98**
Last month	251.70
November, 1946	286.77
November, 1945	145.63

Chlorate, kegs, lb.	$0.06½ -	$0.08
Cyanide, cases, dom., lb.	.14½ -	.15
Fluoride, bbl., lb.	.09½ -	.09¾
Hyposulphite, bags, 100 lb.	2.75 -	3.15
Metasilicate, bbl., 100 lb.	3.40 -	4.00
Nitrate, bulk, ton	32.00 -	38.50
Nitrite, casks, lb.	.06½ -	.07
Phosphate, tribasic, bags, 100 lb.	3.50 -	4.00
Prussiate, yel., bags, lb.	.12 -	.12½
Silicate, 40°, dr., wks., 100 lb.	.95 -	1.00
Sulphite, crys., bbl., lb.	.03 -	.04
Sulphur, crude at mine, long ton	16.00 -	18.00
Dioxide, cyl., lb.	.085-	.09
Dioxide, tanks, lb.	.044-	
Tin crystals, bbl., lb.	.55 -	
Zinc chloride, gran., bbl., lb.	.07 -	.07½
Oxide, lead free, bags, lb.	.10 -	.10½
Oxide, 35%, leaded, bags, lb.	.11½ -	.12
Sulphate, bags, cwt.	4.15 -	7.00
OILS AND FATS		
Castor oil, No. 3 dr., lb.	$0.28½ -	
Chinawood, oil, tanks, lb.	.24 -	
Coconut oil, ceylon, N. Y., lb.	.20 -	
Corn oil, crude, tanks (f.o.b. mill), lb.	.24 -	
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.21½ -	
Linseed oil, raw, car lots, dr., lb.	.309-	
Palm, casks, lb.	nom.	
Peanut oil, crude, tanks (mill), lb.	.24 -	
Rapeseed oil, refined, bbl., lb.	nom.	
Soybean, tanks, lb.	.21 -	
Menhaden, light, pressed dr., lb.	.20 -	
Crude, tanks (f.o.b. factory), lb.	.18 -	
Grease, yellow, loose, lb.	.20½ -	
Oleo stearine, lb.	nom.	
Oleo oil, No. 1, lb.	.28 -	
Red oil, distilled, bbl., lb.	.28 -	
Tallow, extra, loose, lb.	.22½ -	
COAL TAR PRODUCTS		
Alpha-naphthol, crude, bbl., lb.	$0.64 -	$0.66
Alpha-naphthylamine, bbl., lb.	.35 -	.36
Aniline oil, drums, lb.	.14 -	.15
Aniline salts, bbl., lb.	.22 -	.24
Benzaldehyde, tech., dr., lb.	.45 -	.50
Benzidine base, bbl., lb.	.77 -	.78
Benzoic acid, USP, kegs, lb.	.54 -	.56
Benzol, 90% tanks, works, gal.	.19 -	.21
Benzyl chloride, tech., dr., lb.	.20 -	.21
Beta, naphthol, tech., drums, lb.	.23 -	.24
Cresol, USP, dr., lb.	.14½ -	.15½
Cresylic acid, dr., wks., gal.	1.25 -	1.30
Diphenyl, bbl., lb.	.15 -	.16
Diethylaniline, dr., lb.	.48 -	.50
Dinitrotoluol, bbl., lb.	.18 -	.19
Dinitrophenyl, bbl., lb.	.22 -	.23
Dip oil, 15%, dr., gal.	.23 -	.25
Diphenylamine, dr., f.o.b. wks., lb.	.25 -	
H acid, bbl., lb.	.50 -	.52
Hydroquinone, bbl., lb.	.90 -	.95
Naphthalene, flake, bbl., lb.	.11 -	.11½
Nitrobenzene, dr., lb.	.08½ -	.09
Para-cresol, bbl., lb.	.41 -	.60
Para-nitroaniline, bbl., lb.	.42 -	.43
Phenol, USP, tanks, lb.	.11 -	.11½
Picric acid, bbl., lb.	.30 -	.32
Pyridine, dr., gal.	1.55 -	1.60
Resorcinol, tech., kegs, lb.	.68 -	.70
Salicylic acid, tech., bbl., lb.	.30 -	.35
Solvent naphtha, w.w., tanks, gal.	.25 -	
Toluidin, bbl., lb.	1.00 -	
Toluol, drums, works, gal.	.23 -	
Xylol, com., tanks, gal.	.25 -	
MISCELLANEOUS		
Casein, etch., bbl., lb.	$0.31 -	$0.34
Dry colors:		
Carbon gas, black (wks.), lb.	.04 -	.07
Prussian blue, bbl., lb.	.42 -	.43
Ultramarine blue, bbl., lb.	.13 -	.24
Chrome green, bbl., lb.	.32 -	.42
Carmine red, tins, lb.	5.50 -	6.00
Para toner, lb.	.80 -	.95
Vermilion, English, bbl., lb.	2.50 -	2.70
Chrome yellow, C. P., bbl., lb.	.26 -	.28
Gum copal, Congo bags, lb.	.09 -	.55
Manila, bags, lb.	.09 -	.15
Damar, Batavia, cases, lb.	.10 -	.22
Kauri, cases, lb.	.18 -	.60
Magnesite, calc., ton	52.75 -	57.00
Pumice stone, lump, bbl., lb.	.05 -	.07
Rosin, H., 100 lb.	9.65 -	
Shellac, orange, fine, bags, lb.	.54 -	.56
Bleached, bonedry, bags, lb.	.58 -	.60
T. N. bags, lb.	.54 -	.56
Turpentine, gal.	.74 -	

GETTING GREATER CAPACITY FROM SMALLER REGENERATORS IN REFORMING ORGANIC GASES **POINT No. 4**

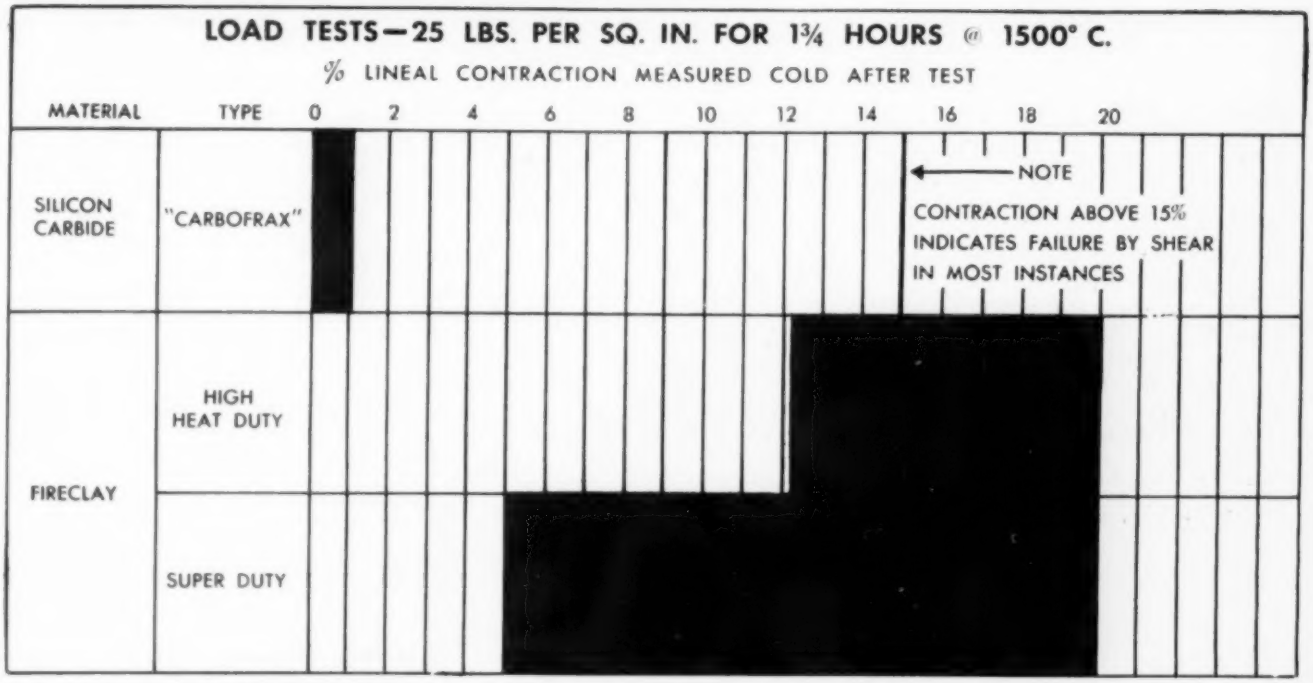


Chart shows the range of values for the different products normally manufactured under each classification.

CARBOFRAX Checkers provide High Refractoriness

Ability to withstand elevated temperatures without deterioration is a proven feature of CARBOFRAX silicon carbide brick. Of equal importance is their high load-carrying strength at such temperatures.

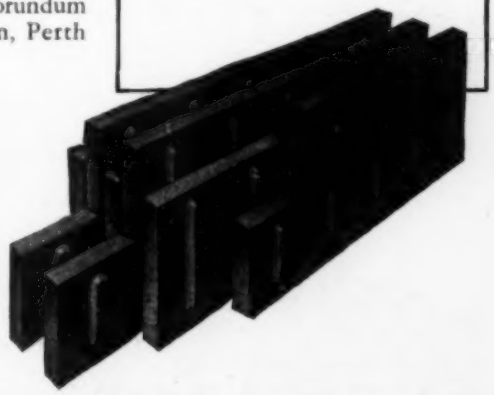
This unique combination of properties permits higher temperature operation. Freedom from softening and subsequent deformation of the checkerwork is assured. Costly rebuilds at frequent intervals are eliminated. Where rapid reversals are employed, thin section CARBOFRAX checker brick can be used without distortion from heavy superimposed loads.

Retaining their hard, dense surface at elevated temperatures CARBOFRAX checkers are impervious to carbon deposition and penetration. Blocking of flues is avoided. Disintegration of the refractory is prevented—a factor especially important in hydrocarbon cracking.

If your processes involve high temperature heating and cracking look into the advantages of CARBOFRAX checkers. Our engineering staff will be glad to assist you. Write Dept. D-117, The Carborundum Company, Refractories Divison, Perth Amboy, New Jersey.

5 ADVANTAGES Offered by CARBOFRAX Checkers

1. Faster Heat Absorption
2. Faster Saturation
3. Faster Heat Release
4. High Refractoriness
5. Greater Spalling Resistance



SUPER REFRACTORIES

BY **CARBORUNDUM**

TRADE MARK

"Carborundum" and "Carbofrax" are registered trademarks which indicate manufacture by The Carborundum Company

NEW CONSTRUCTION

	Current Projects		Cumulative 1947	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	.....	$8,961,000	$2,729,000
Middle Atlantic	$3,100,000	$1,264,000	11,042,000	34,330,000
South	500,000	425,000	22,758,000	46,884,000
Middle West	.....	832,000	16,592,000	21,165,000
West of Mississippi	20,000,000	38,475,000	275,137,000	140,052,000
Far West	100,000	3,405,000	5,306,000	16,854,000
Canada	.....	.....	40,212,000	33,835,000
Total	$23,700,000	$44,401,000	$380,008,000	$295,849,000

Proposed Work

Calif., San Jose—Mun-Dell Paper Co., 79 North Market St., San Jose, Calif., plans to construct a paper plant. Estimated cost $100,000.

Kan., Ulysses—Cities Service Gas Co., First Natl. Bank Bldg., Oklahoma City, Okla., plans to enlarge its compressor station here. Estimated cost $2,000,000.

N. Y., Brooklyn—E. A. Laboratories, Inc., 696 Myrtle Ave., is having plans prepared by Andrew V. Bekay, 323 Elmwood Ave., for a 5 story factory. Estimated cost $350,000.

N. Y., Niagara Falls—International Paper Co., Niagara Falls, plans an expansion program for 1948 including a steam boiler plant. Estimated cost $1,250,000.

Pa., Harmarville—Gulf Research & Development Co., Harmarville, is having plans prepared by Prack & Prack, 517 Martin Bldg., Neville Island, Pittsburgh, for a laboratory. Estimated cost $1,500,000.

Tenn., Chattanooga—Tennessee Products & Chemical Corp., Alton Park, plans to construct an addition to its plant. Estimated cost $500,000.

Tex., Corpus Christi—Continental Oil Co., Oil & Gas Bldg., plans to construct a crude oil refinery and natural gas processing plant near here. Estimated cost $18,000,000.

Contracts Awarded

Ala., Mobile—National Gypsum Co., Baker St., has awarded the contract for an addition to its plant to Blaw-Knox Co. c/o Owner. Estimated cost $150,000.

Calif., San Leandro—Western Waxed Paper Co., Div. of Crown-Zellerbach Corp., 1311 63rd St., Emeryville, has awarded the contract for the construction of a laboratory to Christensen & Lyons Construction Co., 3454 Harlan Ave., Oakland. Estimated cost $55,000.

Calif., Santa Clara—Owens-Corning Fiberglass Corp, 1500 Nicholas Bldg., Toledo, O., has awarded the contract for a factory building here to Bechtel Construction Co., 225 Bush St., San Francisco. Estimated cost $500,000.

Fla., Jacksonville—Wilson-Toomer Fertilizer Co., 772 West Bay St., will construct a warehouse and mixing plant on Talleyrand Ave. in East Jacksonville. Work will be done by owner. Estimated cost $120,000.

Ind., Gary—Gary Paper Mills, Inc., c/o Gary Post Tribune, 415 Bway., has awarded the contract for a newsprint reclamation mill and office building to Alfred Patch, 131 East 5th St. Estimated cost $500,000.

Ind., Terre Haute—Terre Haute Gas Corporation, R. S. Brunner, Pres., has awarded the contract for a propane liquid petroleum fluid gas plant including a 1 story, 40x60 ft. industrial type building, to J. F. Pritchard & Co., 2200 Fidelity Bldg., Kansas City, Mo. Estimated cost $200,000.

Ia., Dubuque—Algonquin Chemical Co., c/o H. D. McGowan, Vice Pres., Julian Hotel, has awarded the contract for a 2 story, 112x113 ft. building for the manufacture of sulphuric acid to Equipment Maintenance Co., 637 Andrus Bldg., Minneapolis, Minn. Estimated cost $1,000,000.

Kan., Kansas City—Procter & Gamble, Gwynne Bldg., Cincinnati, O., has awarded the contract for a 5 story addition to its soap manufacturing plant to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Estimated cost $1,000,000.

La., Bogalusia—Louisiana Tung Mill, Inc., has awarded the contract for a manufacturing plant to Stocker Construction Co., 812 Olive St., St. Louis, Mo. Estimated cost $100,000.

Md., Brooklyn and Baltimore—General Refractories Co., F. Miller, Ch. Eng., Real Estate Trust Bldg., Philadelphia, Pa., will construct the foundation for the first unit of a pilot plant and second unit of laboratory and office building. Work will be done with own forces. Estimated cost $250,000.

Minn., Minneapolis—Minnesota Linseed Oil Paint Co., 1101 Third St., has awarded the contract for a vegetable oil processing plant to Feagles Construction Co., 711 Wesley Temple Bldg. Estimated cost $2,000,000.

Mo., St. Louis—Mallinckrodt Chemical Works, 3600 North Second St., has awarded the contract for construction and completion of 3 story boiler plant to Dickie Construction Co., 317 North 11th St. Estimated cost $70,000.

N. J., Newark—Atlantic Refining Co., 260 South Broad St., Philadelphia, Pa., has awarded the contract for a tank building and one for equipment and miscellaneous uses to J. Rich Steers, Inc., 17 Battery Pl., New York, N. Y. Estimated cost $576,000 and $378,000 respectively.

N. Y., Yonkers—Pyridium Corp., Nepera Park, has awarded the contract for a 2 story laboratory to A. Barbaresi & Sons, Inc., 10 Fisk Pl., Mt. Vernon. Estimated cost $60,000.

N. C., Aberdeen—Colonial Mills, c/o C. M. Guest & Son, contractor, Anderson, S. C., plans to construct a rayon plant here. Estimated cost will exceed $55,000.

O., Cincinnati—Hilton-Davis Chemical Co., 2235 Langdon Farm Rd., has awarded the contract for a 2 story, 80x100 ft. chemical manufacturing plant to Holt & Reichard Construction Co., 12 East McMillan St. Estimated cost $132,000.

Okla., Hocker—Harrington & Marsh, Amarillo, Tex., have awarded the contract for a natural gas processing plant to J. F. Pritchard & Co., Fidelity Bldg., Kansas City, Mo. Estimated cost $15,000,000.

Okla., Velma—Skelly Oil Co., Skelly Bldg., Tulsa, has awarded the contract for a natural gasoline plant to Born Engineering Co., Admiral Blvd., Tulsa. Estimated cost $7,000,000.

Tex., Houston—Cook Paint & Varnish Co., 1816 Main St., has awarded the contract for a 3 story factory and warehouse to J. A. Jones Construction Co., 117 East 11th St. Estimated cost $340,000.

Tex., Katy—Humble Oil & Refining Co., 1216 Main St., Houston, has awarded the contract for a recycling plant to Stearns-Roger Mfg. Co., 17 California St., Denver, Colo. Estimated cost $6,860,000.

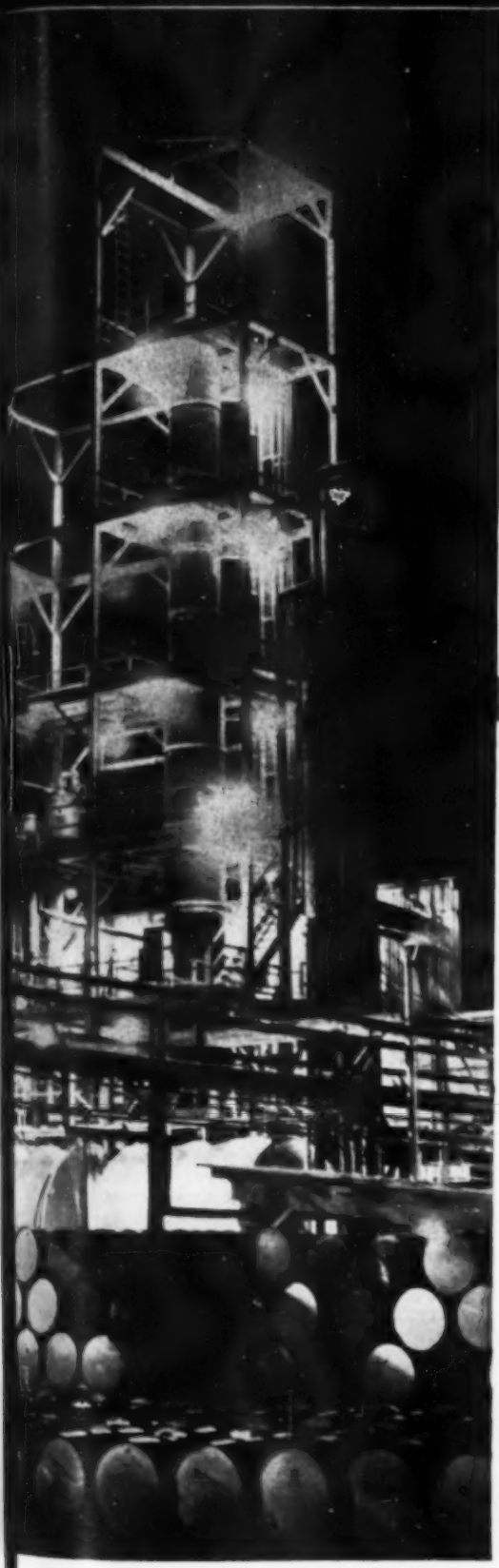
Tex., Silsbee—American Republics Corp., c/o Houston Oil Co., Esperson Bldg., Houston, has awarded the contract for a gas recycling plant to Gasoline Plant Corp., Nils Esperson Bldg. Estimated cost $3,000,000.

Tex., Willis—Gray Wolfe Co., Second Natl. Bank Bldg., Houston, will construct a recycling plant. Work will be done by owners. Estimated cost $2,000,000.

Tex., Winnsboro—Winnsboro Refining Co. has awarded the contract for a 3,000 bbl. crude oil refining plant to Mid-Continent Engineering Co., Inc., 25½ Highland Park Shopping Village, Dallas. Estimated cost $200,000.

Utah, Sigurd—U. S. Gypsum Co., 300 West Adams St., Chicago, Ill., has awarded the contract for a gypsum products plant to W. W. Clyde & Co., Springville and Ellis E. Barker, Ness Bldg., Salt Lake City, Utah. Estimated cost between $1,000,000 and $1,250,000.

Wash., Vancouver—Bemis Paper Bag Co., c/o Building Dept., 601 South 4th St., St. Louis, Mo., has awarded the contract for a paper bag fabricating plant to Ross B. Hammond Co., 1214 North William St., Portland, Ore. Estimated cost $600,000.



guide and directory

21st EXPOSITION OF CHEMICAL INDUSTRIES

grand central palace, new york city

december 1 to 6, 1947

ADVISORY COMMITTEE

RAYMOND F. BACON
Consulting Chemist

WALLACE COHOE
Pres., The Chemists' Club

HUGH CRAIG
Editor, "Oil, Paint & Drug Reporter"

J. V. N. DORR
Pres., The Dorr Company

J. E. FERRIS
Pres., Salesmen's Ass'n. of American Chemical Industry

GEORGE W. HEISE
Pres., The Electrochemical Society

SIDNEY D. KIRKPATRICK
Editor, "Chemical Engineering"

WALTER J. MURPHY
Editor, "Industrial and Engineering Chemistry"

W. ALBERT NOYES, JR.
Pres., American Chemical Society

W. T. READ
General Staff, War Department

CHARLES F. ROTH
Manager Exposition

E. K. STEVENS
Associate Mgr., Exposition

CHARLES M. A. STINE
Pres., American Institute of Chemical Engineers

ROBERT L. TAYLOR
Editor, "Chemical Industries"

R. GORDON WALKER
Vice Pres., Oliver United Filters, Inc.

E. R. WEIDLEIN
Director, Mellon Institute

★ EXHIBITORS ★

	Space No.
Ace Glass Incorporated, Vineland, N. J.	383
Aetna Scientific Company, 2nd & Spring Sts., Everett, Mass.	218
Alberene Stone Corporation of Virginia, 419 Fourth Ave., New York 16, N. Y.	79
Allegheny Ludlum Steel Corporation, 532 Oliver Bldg., Pittsburgh 22, Pa.	250–252–254
Allis-Chalmers Manufacturing Company, Milwaukee 1, Wisc.	48–49
Allis Co., The Louis, Milwaukee 7, Wisc.	320–322
Alloy Steel Products Company, Linden, N. J.	669–670
Alrose Chemical Co., 180 Mill St., Cranston, R. I.	490
Alsop Engineering Corporation, Milldale, Conn.	293
Aluminum Company of America, Pittsburgh 19, Pa.	70–71
Amecco Chemicals, Inc., 60 E. 42nd St., New York 17, N. Y.	648–649
American Chemical Society, 1155 Sixteenth St. N.W., Washington, D. C.	7 E
American Hard Rubber Company, 11 Mercer St., New York 13, N. Y.	303–305
American Instrument Company, 8010 Georgia Ave., Silver Spring, Md.	385–387
American Machine and Metals Inc., Tolhurst Centrifugal Division, East Moline, Ill.	68–69
American Meter Company, 60 E. 42nd St., New York 17, N. Y.	39–40–41
American Platinum Works, 231 N. J. R. R. Ave., Newark 5, N. J.	456
American Resinous Chemicals Corporation, Peabody, Mass.	35–36
American Tool & Machine Company, 1415 Hyde Park Ave., Boston, Mass.	412
American Wheelabrator & Equipment Corporation, Mishawaka, Ind.	481–482–483–484
Amersil Company, Hillside, N. J.	454
Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 4, Wisc.	268
Andrews-Knapp Construction Co., Inc., 121 Broad St., New York 4, N. Y.	23
Angel & Company, H. Reeve, 52 Duane St., New York 7, N. Y.	214
Ansul Chemical Company, Marinette, Wisc.	81–82
Artisan Metal Products, Inc., Boston, Mass.	540–541–542
Associated Cooperage Industries of America, Inc., 408 Olive St., St. Louis 2, Mo.	242
Atlas Powder Company, Wilmington 99, Dela.	46–47
Bailey Meter Company, 1050 Ivanhoe Road, Cleveland 10, Ohio	274–276
Baird Associates, Inc., 33 University Road, Cambridge, Mass.	610
Bakelite Corporation, 300 Madison Ave., New York 17, N. Y.	17–18
Baker & Company, 113 Astor St., Newark 5, N. J.	451–452
Baker Instrument Co., 17 S. Day St., Orange, N. J.	640 C
Baker Perkins, Inc., Saginaw, Mich.	62–63
Baldwin Belting, Inc., 85 Chambers St., New York 7, N. Y.	662
Barco Manufacturing Co., 1801 Winnemac Ave., Chicago 40, Ill.	515
Bareco Oil Company, Box 2009, Tulsa, Okla.	629–630
Barrett-Cravens Company, 3255 W. 30th St., Chicago 23, Ill.	239
Barnstead Still & Sterilizer Co., Inc., 2 Lanesville Terrace, Forest Hills, Boston 31, Mass.	229–231
Bartlett & Snow Co., The C. O., 6200 Harvard Ave., Cleveland 5, Ohio	427–428
Bemis Bro. Bag Company, 408 Pine St., St. Louis 2, Mo.	338–340
Berger Manufacturing Division, Republic Steel Corporation, Canton, O.	434–435–436
Bird Machine Company, South Walpole, Mass.	535–536–543–544
Black, Sivalls & Bryson, Inc., 106 W. 14th St., Kansas City 6, Mo.	496
Blaw-Knox Division of Blaw-Knox Company, P. O. Box 1198, Pittsburgh, Pa.	13–14
Blickman, Inc., S., Weehawken, N. J.	474–475
Bolt and Nut Division—Republic Steel Corporation, Cleveland, Ohio	434–435–436
Bowen Engineering, Inc., Garwood, N. J.	493–494–495
Brabender Corporation, Rochelle Park, N. J.	272
Bramley Machinery Corporation, 15 Park Row, New York 7, N. Y.	524–525
Brookfield Engineering Laboratories, Inc., Stoughton, Mass.	601 C
Buflovak Equipment Division of Blaw-Knox Company, Buffalo 11, N. Y.	6
Builders Providence, Inc., 9 Codding St., Providence 1, R. I.	479
Burling Instrument Company, 233 Springfield Ave., Newark 3, N. J.	403
By-Products Steel Co., Coatesville, Pa.	558–563
Cambridge Instrument Company, Inc., Grand Central Terminal, New York 17, N. Y.	330–332
Carbide & Carbon Chemicals Corporation, 300 Madison Ave., New York 17, N. Y.	17–18
Cargocaire Engineering Corporation, 15 Park Row, New York 7, N. Y.	621
Carnegie-Illinois Steel Corporation, Pittsburgh, Pa.	76–77
Carpenter Container Corporation, 137–147–41st St., Brooklyn 32, N. Y.	261
Carpenter Steel Company, The, Alloy Tube Division, Union, N. J.	491–492
Carver, Inc., Fred S., 345 Hudson St., New York 14, N. Y.	237
Chase Bottle & Supply Corp., 47 E. 19 St., New York, N. Y.	547
Chemical Engineering, 330 W. 42nd St., New York 18, N. Y.	42
Chemical Engineering Catalog, 330 W. 42nd St., New York 18, N. Y.	26–27
Chemical and Engineering News, 330 W. 42nd St., New York 18, N. Y.	26–27
Chemical Engineering Progress, 50 E. 41st St., New York 17, N. Y.	659 A
Chemical Industries, 522 Fifth Ave., New York 18, N. Y.	28 E & 28 W
Chemical Preview, 737 N. Michigan Ave., Chicago 11, Ill.	506
Chemicolloid Laboratories, Inc., 44 Whitehall St., New York 4, N. Y.	257
Chemists' Club, The, 52 E. 41st St., New York 17, N. Y.	A-Main
Cleveland Worm & Gear Company, The, 3249 E. 80th St., Cleveland 4, Ohio	502–503
Coleman Instruments Inc., 318 Madison St., Maywood, Ill.	381 & A
Commercial Solvents Corporation, 17 E. 42nd St., New York 17, N. Y.	55
Conkey Filter Company, 10 E. 49th St., New York 17, N. Y.	285–287
Container Company, Inc., The, Division of Continental Can Company, P. O. Box 310, Van Wert, Ohio, N. Y. Office, 100 E. 42nd St. (17)	243–245
Continental Diamond Fibre Company, Newark, Dela.	51
Continental Equipment Corporation, 30 Church St., New York 7, N. Y.	663
Cooper Alloy Foundry Co., The, Bloy St. & Ramsey Ave., Hillside, N. J.	565–566
Cornell Machine Company, The, 101 Park Ave., New York 17, N. Y.	633
Corning Glass Works, Corning, N. Y.	391–393–395
Cowles Company, The, Cayuga, N. Y.	572
Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.	297
Croll-Reynolds Engineering Co., 17 John St., New York, N. Y.	548
Culvert Division—Republic Steel Corporation, Cleveland, Ohio	434–435–436
Darco Corporation, 60 E. 42nd St., New York 17, N. Y.	46–47
Davison Chemical Corporation, The, Baltimore 3, Md.	622–623–624
DeLaval Separator Company, 165 Broadway, New York 6, N. Y.	323
Denver Equipment Company, 1400–17th St., P. O. Box 5268, Denver 17, Colo.	507
Dicalite Company, The, 120 Wall St., New York 5, N. Y.	86
Distillation Products, Inc., 755 Ridge Road West, Rochester 13, N. Y.	625–626
Dorr Company, Inc., The, 570 Lexington Ave., New York 22, N. Y.	64
Duriron Company, Inc., The, Dayton 1, Ohio.	19–20

Index As Supplied by the Exposition Management

21st EXPOSITION CHEMICAL INDUSTRIES

	Space No.
Eastern Industries, Incorporated, 296 Elm St., New Haven 4, Conn	220–222–224
Eclipse Fuel Engineering Co., Rockford, Ill	504
Eco Engineering Company, Div. of Economy Faucet Co., 11 New York Ave., Newark, N. J	641
Economic Machinery Company, Worcester 3, Mass	545–546
Eimco Corporation, The, 634–666 S. Fourth West St., Salt Lake City, Utah	605–606
Eimer and Amend, Greenwich & Morton Sts., New York 14, N. Y	57
Electric Hotpack Company, Inc., The, Cottman Ave. at Melrose St., Philadelphia 32, Pa	655–656
Electro Chemical Supply & Engineering Company, Paoli, Pa	81
Engelhard, Inc., Chas., 233 N. J. R. R. Ave., Newark 5, N. J	455
Eppenbach, Inc., 45–10 Vernon Blvd., Long Island City 1, N. Y	289
Eriez Manufacturing Company, Erie, Pa	631
Ertel Engineering Corp., 40 W. 48th St., New York 19, N. Y	508–509
Evans Chemetics, Inc., 250 E. 43rd St., New York 17, N. Y	461
Evans Research and Development Corporation, 250 E. 43rd St., New York 17, N. Y	489
Exact Weight Scale Company, The, Columbus 8, Ohio	476
Falstrom Company, Main Ave. at D. L. & W. R. R., Passaic, N. J	510–511
Fansteel Metallurgical Corporation, North Chicago, Ill	282–284
Farval Corporation, The, 3249 E. 80th St., Cleveland 4, Ohio	502–503
Federal Classifier Systems, Inc., 127 N. Dearborn St., Chicago 2, Ill	404
Fenwal Incorporated, Ashland, Mass	640 A
Ferguson Co., Harry J., 115 West Ave., Jenkintown, Pa	601–602
Filtration Engineers Incorporated, 858 Summer St., Newark 4, N. J	8
Fischer & Porter Company, Hatboro, Pa	203–205–207
Fisher Scientific Company, 711 Forbes St., Pittsburgh, Pa	57
Fitzpatrick Company, The W. J., 1001 Washington Blvd., Chicago 7, Ill	401–402
Fletcher Works, Inc., Glenwood Ave. & 2nd St., Philadelphia 40, Pa	33
Food Industries, 330 W. 42nd St., New York 18, N. Y	42
Food Processing Preview, 737 N. Michigan Ave., Chicago 11, Ill	506
Foote Mineral Company, 10 E. Chilten Ave., Philadelphia 44, Pa	607–608
Fuller Company, Fuller Bldg., Catasauqua, Pa	315–317
Fulton Bag & Cotton Mills, P. O. Box 1726, Atlanta 1, Ga	424
Gamma Scientific Company, Inc., 95 Madison Ave., New York 16, N. Y	497
Garlock Packing Company, The, Palmyra, N. Y	244
General Alloys Company, 30 Ipswich St., Boston 15, Mass	299
General American Transportation Corporation, 133 S. LaSalle St., Chicago 90, Ill.; N. Y. Off., 10 E. 49th St., (17)	285–287
General Aniline & Film Corporation, 230 Park Ave., New York 17, N. Y	619–620
General Ceramics and Steatite Corporation, Keasbey, N. J	2
General Electric Company, 1 River Road, Schenectady 5, N. Y	4
Glascote Products, Inc., 20900 St. Clair Ave., Cleveland 17, Ohio	657–658
Glengarry Machine Works, Inc., Bay Shore, N. Y	659–660
Globe Stainless Steel Tube Co., Milwaukee 4, Wisc	537–538
Globe Steel Tubes Co., Milwaukee 4, Wisc	537–538
Glyco Products Co. Inc., 26 Court St., Brooklyn 2, N. Y.	225–227
Gordon Company, James T., 233 Broadway, New York 7, N. Y	502–503
Goslin-Birmingham Manufacturing Co. Inc., Birmingham 1, Ala	74
Great Western Manufacturing Co., Leavenworth, Kansas	372–374
Greiner Company, The Emil, 161 Sixth Ave., New York 13, N. Y	226–228
Grinnell Company, Providence 1, R. I	251
Grove Regulator Company, 6529 Hollis St., Oakland 8, Calif.	640 D
Gump Company, B. F., 431 S. Clinton St., Chicago 7, Ill	362–364
Hammond Drierite Company, W. A., Xenia, Ohio	266
Hanovia Chemical and Manufacturing Company, Chestnut St. & N. J. R. R. Ave., Newark 5, N. J	457–458
Hardesty Chemical Co. Inc., 41 E. 42nd St., New York 17, N. Y	648–649
Hardinge Company, York, Pa	60
Hart-Moisture-Meters, 1948 Grand Central Terminal, New York 17, N. Y	400 A
Hasco Valve and Machine Co., 1819 West St. Paul Ave., Milwaukee 3, Wisc	569
Haveg Corporation, Newark, Dela	51
Haynes Stellite Company, 30 E. 42nd St., New York 17, N. Y.	92
Heil Process Equipment Corporation, 12901 Elmwood Ave., Cleveland 11, Ohio	575
Hercules Filter Corporation, 204 21st St., Paterson 3, N. J	443–444–445
Hercules Powder Company, Wilmington, Dela	7 W
Hersey Manufacturing Company, E & 2nd Sts., S. Boston 27, Mass	499
Hills-McCanna Company, 3025 North Western Ave., Chicago 18, Ill	346
Hoke, Incorporated, S. Dean St. & Garrett Pl., Englewood, N. J	213
Horix Manufacturing Company, Corliss Station, Pittsburgh, Pa	413–414
Hormann and Company, Inc., F. R., 186 Joralemon St., Brooklyn, N. Y	680
Hyster Company, Peoria, Ill.; N. Y. Off., 90 West St. (6)	573–574
Illinois Electric Porcelain Co., Macomb, Ill	672–673
Illinois Testing Laboratories, Inc., 420 N. LaSalle St., Chicago 10, Ill	38
Illinois Water Treatment Company, Rockford, Ill	635
Industrial and Engineering Chemistry, 1155 Sixteenth St. N.W., Washington, D. C	26–27
Industrial Instruments, Inc., 17 Pollock Ave., Jersey City 5, N. J	410
Industrial Process Engineers, 5204 Hudson Ave., West N. Y., N. J	441
Industrial Steels, Inc., 246 Bent St., Cambridge 11, Mass	650
Ingersoll-Rand Company, 11 Broadway, New York 4, N. Y	615–616–617
International Nickel Company, Inc., 67 Wall St., New York 5, N. Y	9–10
Interscience Publishers, Inc., 215 Fourth Ave., New York 3, N. Y	467
Jabsco Pump Company, 2031 N. Lincoln St., Burbank, Calif.	678
Jacoby, M.E., Henry E., 205 E. 42nd St., New York 17, N. Y	540–541–542
Jacoby-Tarbox Corporation, 453 Nepperhan Ave., Yonkers 3, N. Y	540–541–542
Jay Bee Manufacturing Co., Tyler, Tenn	370
Jay Bee Sales Company, 220 Broadway, New York 7, N. Y.	370
Jeffrey Manufacturing Company, The, Columbus 16, Ohio	44A-45
Jerguson Gage & Valve Co., 87 Fullsway, Somerville 45, Mass.	564
Johns-Manville Sales Corporation, 22 E. 40th St., New York 16, N. Y	93–94
Kewaunee Mfg. Co., Adrian, Mich	308–310
Kidde & Company, Inc., Walter, 675 Main St., Belleville 9, N. J	423
Kiefer Machine Co., The Karl, Cincinnati 2, Ohio	24
Kieley & Mueller, Inc., 2013-43rd St., North Bergen, N. J.	643
Kimble Glass Division—Owens Illinois Glass Company, P. O. Box 1035, Toledo 1, Ohio	342–344
Kinney Manufacturing Company, 3529 Washington St., Boston 30, Mass	468–469
Knapp Mills, Incorporated, 121 Broad St., New York 4, N. Y.	23

Index As Supplied by the Exposition Management

	Space No.
Knight, Maurice A., Kelly Ave., Akron 9, Ohio	53
Koppers Company, Inc., Pittsburgh 19, Pa	264
Koven & Brother, Inc., L. O., 154 Ogden Ave., Jersey City 7, N. J	304–306
Laboratory Furniture Co. Inc., 37-18 Northern Blvd., Long Island City 1, N. Y	221–223
LaBour Company, Inc., The, Elkhart, Ind	32
Ladish Co., Cudahy, Wisc	613–614
Lapp Insulator Co. Inc., LeRoy, N. Y	500–501
Lakso Company, The, P. O. Box 257, Fitchburg, Mass	461 B
Lawrence Machine & Pump Corp., 30 Church St., New York 7, N. Y	663
Lead Lined Iron Pipe Co., Wakefield, Mass	23
Lebanon Steel Foundry, Lebanon, Pa	465–466
Leslie Co., Lyndhurst, N. J	676
Louisville Drying Machinery Co., 506 W. Walnut St., Louisville 2, Ky	285–287
Lukens Steel Company and Divisions, Coatesville, Pa.	558–559–560–561–562–563
Lukenweld, Inc., Coatesville, Pa	558–563
Luzerne Rubber Company, The, Trenton 9, N. J	528–529
McGraw-Hill Book Company, 330 W. 42nd St., New York 18, N. Y	283
McGraw-Hill Publishing Company, 330 W. 42nd St., New York 18, N. Y	42
M R M Company, Inc., 191 Berry St., Brooklyn 11, N. Y.	638
Macbeth Corporation, 227 W. 17th St., New York 11, N. Y.	201
Magna Manufacturing Company Inc., 444 Madison Ave., New York 22, N. Y	609
Magnus, Mabee & Reynard, Inc., 16 Desbrosses St., New York 13, N. Y	498
Makepeace Co., David, Attleboro, Mass	453
Marco Company, Inc., 3rd & Church Sts., Wilmington 50, Dela.	646–647
Marlow Pumps, Inc., Ridgewood, N. J	431
Marsh Stencil Machine Co., Belleville, Ill	411
Martindale Electric Company, The, 1375 Hird St., Lakewood, Cleveland, Ohio	440
Materials and Methods, 330 W. 42nd St., New York 18, N. Y.	26–27
Matheson Co. Inc., The, East Rutherford, N. J	271
Meriam Instrument Co., The, 10920 Madison Ave., Cleveland 2, Ohio	512–513
Metalab Equipment Corporation, 1529 Dean St., Brooklyn 13, N. Y	462–463–464
Metal Glass Products Company, Belding, Mich	425–426
Metalsalts Corporation, 27 First Ave., Paterson, N. J	470
Metals Industries Catalog, 330 W. 42nd St., New York 18, N. Y	26–27
Micro Metallic Corporation, 193 Bradford St., Brooklyn, N. Y.	671
Mine Safety Appliances Company, Braddock, Thomas & Meade Sts., Pittsburgh 8, Pa	376–378
Mixing Equipment Company, Inc., 1024 Garson St., Rochester 9, N. Y	307–309–334–336
Monarch Manufacturing Works, Inc., 2501 East Ontario St., Philadelphia 34, Pa	354
Munn and Steele, Inc., 130 Lister Ave., Newark 5, N. J	406
Nash Engineering Company, The, South Norwalk, Conn	16
National Carbon Company, Inc., 30 E. 42nd St., New York 17, N. Y	30–31
National Engineering Company, 549 W. Washington Blvd., Chicago 6, Ill	554–555
National Lead Company, 111 Broadway, New York 6, N. Y.	247
National Radiator Company, The, Johnstown, Pa	611–612
National Research Corp., Vacuum Engineering Division, 70 Memorial Drive, Cambridge, Mass.	472–473
National Technical Laboratories, 820 Mission St., S. Pasadena, Calif.	265–267–269
National Tube Company, Pittsburgh, Pa	76–77
Newark Wire Cloth Company, 351 Verona Ave., Newark 4, N. J	83–84
New England Tank and Tower Company, Everett, Mass.	50
New Jersey Machine Corporation, Willow Ave. at 16th St., Hoboken, N. J	485–486
Niagara Blower Company, 405 Lexington Ave., New York 17, N. Y	233–235
Niagara Filter Corporation, 3080 Main St., Buffalo 14, N. Y.	417–418
Niles Steel Products Division—Republic Steel Corporation, Niles, O	434–435–436
Nordstrom Valve Division—Rockwell Manufacturing Company, 400 N. Lexington Ave., Pittsburgh 8, Pa	61
North American Philips Company, Inc., 100 E. 42nd St., New York 17, N. Y	539
Norton Company, Worcester 6, Mass	415–416
Ohio Chemical & Mfg. Co., The, 60 E. 42nd St., New York 17, N. Y	216
Oliver United Filters, Inc., 33 W. 42nd St., New York 18, N. Y	66
Omega Machine Co., 122 S. Michigan Ave., Chicago 3, Ill.	480
Overstrom & Sons, 2217 W. Mission Road, Alhambra, Calif.	52
Owens-Corning Fiberglas Corporation, Toledo 1, Ohio	437–438–439
Palo-Myers, Inc., 81 Reade St., New York 7, N. Y	642
Pangborn Corporation, Hagerstown, Md	75
Parker Appliance Company, The, 17325 Euclid Ave., Cleveland 12, Ohio	21
Patterson-Kelley Co. Inc., The, 101 Park Ave., New York 17, N. Y.	248
PerfeKtum Products Co., 300 Fourth Ave., New York 10, N. Y.	209–211
Perkin-Elmer Corporation, The, Glenbrook, Conn	442
Perl-Oussani Machine Manufacturing Company, 68 Jay St., Brooklyn 1, N. Y	604
Permutit Company, The, 330 W. 42nd St., New York 18, N. Y.	400
Petroleum Specialties, Inc., 400 Madison Ave., New York 17, N. Y	471
Pfaudler Co., The, 89 East Ave., Rochester 4, N. Y.	72–73
Pfizer & Co. Inc., Chas., 81 Maiden Lane, New York 7, N. Y.	5
Philadelphia Gear Works, Inc., G St. below Erie Ave., Philadelphia 34, Pa.; N. Y. Off., 330 W. 42nd St. (18)	78
Photoswitch Incorporated, 77 Broadway, Cambridge 42, Mass.	603
Photovolt Corporation, 95 Madison Ave., New York 16, N. Y.	270
Pioneer Rubber Company, The, Willard, Ohio	429
Pittsburgh Equitable Meter Division—Rockwell Manufacturing Company, 400 N. Lexington Ave., Pittsburgh 8, Pa.	61
Pneumatic Scale Corporation Limited, North Quincy 71, Mass.	22
Popper & Klein, Inc., 300 Fourth Ave., New York 10, N. Y.	209–211
Powell Company, The Wm., 2503 Spring Grove Ave., Cincinnati 22, Ohio	54
Precision Scientific Company, 3737 W. Cortland St., Chicago 47, Ill	601 D
Premier Mill Corporation, 218 Genesee St., Geneva, N. Y.	312–314
Pressed Steel Tank Company, Milwaukee 14, Wisc.	348–350–352
Process & Instruments, 60 Greenpoint Ave., Brooklyn 22, N. Y	518
Proctor & Schwartz, Inc., 7th St. & Tabor Road, Philadelphia 20, Pa	15
Productive Equipment Corporation, 2926 W. Lake St., Chicago 12, Ill	549
Progressive Architecture, 330 W. 42nd St., New York 18, N. Y.	26–27
%Proportioneers, Inc.%, 9 Codding St., Providence 1, R. I.	477–478
Pulverizing Machinery Company, Chatham Road, Summit, N. J	300–302
Putman Publishing Company, 737 N. Michigan Ave., Chicago 11, Ill	506
Radio Corporation of America, Camden, N. J	627–628
Randolph Laboratories, Inc., 8 E. Kinzie St., Chicago 11, Ill.	677
Rapids-Standard Company, Inc., The, 308 Peoples National Bank Bldg., Grand Rapids 2, Mich	446 to 450
Raymond Pulverizer Division—Combustion Engineering Company, Inc., 1315 N. Branch St., Chicago 22, Ill.; N. Y. Off., 1 Park Ave. (16)	67
Read Machinery Division of the Standard Stoker Company, Inc., York, Pa	280
Reeves Pulley Co. of N. Y. Inc., 76 Dey St., New York 7, N. Y.	34

Index As Supplied by the Exposition Management

WeldELLS *have everything**

See the
Taylor Forge
Exhibit

BOOTH 530

Chemical Industries
Exposition

Grand Central Palace
New York, N. Y.

DEC. 1 to 6

With features that are not combined in any other fittings for pipe welding, WeldELLS give you the means of doing any job as easily as it can be done . . . as well as it can be done . . . and therefore as economically as it can be done.

TAYLOR FORGE & PIPE WORKS General Offices & Works: Chicago 90, Illinois (P. O. Box 485)

New York: 30 Church Street Philadelphia: Broad Street Station Building Chicago District Sales: 208 S. LaSalle Street

Houston: City National Bank Building Los Angeles: Subway Terminal Building

	Space No.
Reichhold Chemicals, Inc., 601 Woodward Heights Blvd., Detroit 20, Mich.	651–652–653–654
Reinhold Publishing Corporation, 330 W. 42nd St., New York 18, N. Y.	26–27
Reliance Electric and Engineering Company, The, 1068 Ivanhoe Road, Cleveland 10, Ohio	674–675
Republic Filters, Inc., 17 Stone St., Newark 4, N. J.	556–557
Republic Steel Corporation, 3100 E. 45th St., Cleveland 20, Ohio	434–435–436
Richmond Manufacturing Company, Lockport, N. Y.	519
Ritter Products Corporation, Ritter Park, Rochester 3, N. Y.	56
Robbins & Myers, Inc., 1345 Lagonda Ave., Springfield, Ohio	639–640
Rockwell Manufacturing Company, 400 N. Lexington Ave., Pittsburgh 8, Pa.	61
Rodgers Company, Inc., George G., 225 W. 34th St., New York 1, N. Y.	679
Roebling's Sons Company, John A., Trenton, N. J.	358–360
Roy Company, Milton, 1300 E. Mermaid Ave., Chestnut Hill, Philadelphia 18, Pa.	432–433
Rubicon Company, Ridge Ave. at 35th St., Philadelphia 32, Pa.	380
Ruggles-Coles Engineering Company, The, York, Pa.	60
St. Regis Sales Corporation, 230 Park Ave., New York 17, N. Y.	531–532
Sarco Company, Inc., Empire State Bldg., New York 1, N. Y.	11
Schneible Company, Claude B., 2827–25th St., Detroit, Mich.	421–422
Schutte & Koerting Company, 12th & Thompson Sts., Philadelphia 22, Pa.	291
Scientific Glass Apparatus Co., 49 Ackerman St., Bloomfield, N. J.	215–217–219
Scott Electroflux Company, 400 Main St., Waltham 54, Mass.	601 B
Sedberry, Inc., J. B., Franklin, Tenn.	370
Seederer-Kohlbusch, Inc., 27–29 S. Van Brunt St., Englewood, N. J.	389
Selas Corporation of America, Erie Ave. & D St., Philadelphia 34, Pa.	533–534
Separations Engineering Corporation, 110 E. 42nd St., New York 17, N. Y.	52
Sharples Chemicals, Inc., 125 S. Broad St., Philadelphia 9, Pa.	25 & 25 A
Sharples Corporation, The, 23rd & Westmoreland Sts., Philadelphia 40, Pa.	58–59
Sheffield Farms Company, Inc., 524 W. 57th St., New York 19, N. Y.	505
Sheldon & Company, E. H., Muskegon, Mich.	255
Shriver & Company, Inc., T., 808 Hamilton St., Harrison, N. J.	12
Simplicity Engineering Company, Durand, Mich.	601 A
Sjostrom Company, John E., 1711 N. 10th St., Philadelphia 22, Pa.	664
Sly Manufacturing Co., The W. W., 4700 Train Ave., Cleveland 2, Ohio	487–488
Snell, Inc., Foster D., 29 W. 15th St., New York 11, N. Y.	37
Socony-Vacuum Oil Company, Inc., 26 Broadway, New York 4, N. Y.	324–326
Sonneborn Sons, Inc., L., 88 Lexington Ave., New York 16, N. Y.	471
Sparkler Manufacturing Company, Mundelein, Ill.	516–517
Sperry & Company, D. R., Batavia, Ill.	540–541–542
Sprout, Waldron & Company, Muncy, Pa.	550–551–552–553
Standard Scientific Supply Corp., 34 W. 4th St., New York 12, N. Y.	618
Steel and Tubes Division—Republic Steel Corporation, Cleveland, Ohio	434–435–436
Stokes Machine Company, F. J., 5810 Tabor Road, Philadelphia, Pa.	80
Struthers Wells Corporation, 30 Rockefeller Plaza, Titusville, Pa.	602 A
Sturtevant Mill Company, Park & Clayton Sts., Dorchester, Boston 22, Mass.	3
Superior Electric Company, The, Bristol, Conn.	522–523
Sutton, Steele & Steele, Inc., Dallas, Texas	52
Swenson Evaporator Company, Div. of Whiting Corporation, Harvey, Ill.	43
Syntron Company, Homer City, Pa.	311–313
Tank Car Division—General American Transportation Corporation, 10 E. 49th St., New York 17, N. Y.	285–287
Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.	530
Tech Laboratories, Inc., 337 Central Ave., Jersey City 7, N. J.	400 A
Technicon Company, The, 215 E. 149th St., New York 51, N. Y.	640 B
Thomas Company, Arthur H., 230 S. 7th St., Philadelphia 5, Pa.	665–666
Titanium Alloy Manufacturing Company, The, 111 Broadway, New York 6, N. Y.	366–368
Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5, N. J.	281
Toledo Scale Company, Toledo 12, Ohio	44 B
Tolhurst Centrifugals Division—American Machine and Metals, Inc., East Moline, Ill.	68–69
Trent, Inc., 501 Leverington Ave., Philadelphia 27, Pa.	526–527
Trent Tube Manufacturing Co., East Troy, Wisc.	644–645
Triangle Package Machinery Co., 906 N. Spaulding Ave., Chicago 51, Ill.	514
Tri-Clover Machine Co., Kenosha, Wisc.	567–568
Tripard Manufacturing Co. Inc., 38 Murray St., New York 7, N. Y.	411
Truscon Steel Company, Div. Republic Steel Corporation, Youngstown, Ohio	434–435–436
Tube Turns, Inc., 224 E. Broadway, Louisville 1, Ky.	636–637
Turbo-Mixer Corporation, 10 E. 49th St., New York 17, N. Y.	285–287
Tyler Company, The W. S., 3615 Superior Ave., Cleveland 14, Ohio	88
Uehling Instrument Company, 473 Getty Ave., Paterson, N. J.	356
Union Bag & Paper Corporation, Woolworth Bldg., New York 7, N. Y.	459–460
Union Carbide & Carbon Corporation, 30 E. 42nd St., New York 17, N. Y.	17–18–30–31 & 92
Union Drawn Steel Division—Republic Steel Corporation, Cleveland, Ohio	434–435–436
Union Process Company, 120 Ash St., Akron 8, Ohio.	572 A
United States Steel Corporation, 436 Seventh Ave., Pittsburgh 30, Pa.	76–77
United States Steel—Coal Chemicals Division, 28 Rockefeller Plaza, New York 20, N. Y.	76–77
United States Steel Products Company, 28 Rockefeller Plaza, New York 20, N. Y.	76–77
United States Steel Supply Company, Chicago, Ill.	76–77
United States Stoneware Company, The, 60 E. 42nd St., New York 17, N. Y.	89–90–91
Vacuum Engineering Division—National Research Corp., 70 Memorial Drive, Cambridge 42, Mass.	472–473
Van Nostrand Company, Inc., D., 250 Fourth Ave., New York 3, N. Y.	85
Wallace & Tiernan Products, Inc., Belleville 9, N. J.	520–521
Walworth Company, 60 E. 42nd St., New York 17, N. Y.	316–318
Watson-Stillman Company, Roselle, N. J.	661
Welch Scientific Company, W. M., 1515 Sedgwick St., Chicago 10, Ill.	405
Welding Engineers, Inc., Norristown, Pa.	407–408
Weston Electrical Instrument Company, 614 Frelinghuysen Ave., Newark, N. J.	263
Whiting Corporation—Swenson Evaporator Company Division, Harvey, Ill.	43
Wiegand Company, Edwin L., 7500 Thomas Blvd., Pittsburgh 8, Pa.	634
Will Corporation, Rochester 3, N. Y.	667–668
Williams Patent Crusher and Pulverizer Co., The, 2701 N. Broadway, St. Louis 6, Mo.	295
Willson Products, Inc., Reading, Pa.	419–420
Winthrop-Stearns, Inc., 170 Varick St., New York 13, N. Y.	430
Worthington Pump and Machinery Corporation, Harrison, N. J.	319–321
Wright-Austin Company, 315 W. Woodbridge St., Detroit 26, Mich.	461 A
Yale & Towne Manufacturing Company, The, 4530 Tacony St., Philadelphia 24, Pa.	278

Index As Supplied by the Exposition Management

EXHIBITORS

CLASSIFIED BY PRODUCTS

ABRASIVES
Johns-Manville Corp. (93–94)
Norton Co. (415–416)
Titanium Alloy Mfg. Co. (366–368) polishing
Will Corp. (667–668)

ACIDS
Ansul Chemical Co. (82) sulfur dioxide
Carbide & Carbon Chemicals Corp. (17–18)
Davison Chemical Corp., The (622–624)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Chas. Pfizer & Co., Inc. (5)
Scientific Glass Apparatus Co., Inc. (215–217–219)
U. S. Steel Corp.
Will Corp. (667–668)

ACIDIFIERS
Ansul Chemical Co (82) sulfur dioxide
Haveg Corp. (51)
Eimer & Amend (57)
Fischer Scientific Co. (57)

ACID PLANTS
Amersil Co., Inc. (454)
Fansteel Metallurgical Corp. (282–284)
General Ceramics & Steatite Corp. (2)
Haveg Corp. (51)
Knapp Mills, Inc. & Andrews-Knapp Construction Co., Inc. (23)
Maurice A. Knight Co. (53)
National Carbon Co., Inc. (30–31)
National Lead Co. (247)

ACID RESISTING MATERIALS
American Hard Rubber Co. (303–305)
Amersil Co., Inc. (454)
Ampco Metal, Inc. (268)
Carpenter Steel Co., Alloy Tube Div. (491–492)
Duriron Co., Inc., The (19–20)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Electro Chemical Supply & Engineering Co. (81)
Fansteel Metallurgical Corp. (282–284)
General Alloys Co. (299)
General Ceramics & Steatite Corp. (2)
Glascote Products, Inc. (657–658)
Haveg Corp. (51)
Haynes Stellite Co. (2)
Heil Process Equip. Corp. (575)
Illinois Electric Porcelain Co. (672–673)
Industrial Steels, Inc. (650)
International Nickel Co., The (9–10)
Kewaunee Mfg. Co. (308–310)
Knapp Mills, Inc. & Andrews-Knapp Construction Co., Inc. (23)
Maurice A. Knight Co. (53)
Lapp Insulator Co., Inc. (500–501)
Lead Lined Iron Pipe Co. (23)
Lukens Steel Co.—By Products Steel Corp. Div. (558–563)
Luzerne Rubber Co. (528–529)
National Carbon Co., Inc. (30–31)
National Lead Co. (247)
Republic Filters, Inc. (556–557)
Republic Steel Corp. (434–436)
U. S. Steel Corp. (76–77)
U. S. Stoneware Co., The (89–91)
Will Corp. (667–668)
Worthington Pump & Machinery Corp. (319–321)

ADHESIVES
American Resinous Chemicals Corp. (35–36)
Commercial Solvents Corp. (55)
General Aniline & Film Corp. (619–620)
Glyco Products Co., Inc. (225–227) wax
Haveg Corp. (51)
Koppers Co., Inc. (264)
Reichhold Chemicals, Inc. (651–654)
U. S. Stoneware Co., The (89–91)
Will Corp. (667–668)

AGITATORS
Alsop Engineering Corp. (293) Hy-speed
American Instrument Co., The (385–387)
S. Blickman, Inc. (474–475)
Chemicolloid Lab, Inc. (257)
Denver Equipment Co. (507)
Dorr Co., The (64–65)
General Ceramics & Steatite Corp. (2)
General American Transportation Corp. (285–287)
B. F. Gump Co. (362–364)
Hardinge Co., Inc. (60)
Haveg Corp. (51)
Industrial Process Engineers (441)
Knapp Mills, Inc., Andrews-Knapp Construction Co., Inc. (23)
L. O. Koven & Bro., Inc. (304–306)
Metal-Glass Products Co. (425–426)
Mixing Equipment Co., Inc. (307–309, 334–336)
New England Tank & Tower Co. (50)
Palo Myers, Inc. (642)
Pfaudler Co., The (72–73)
Read Machinery Div. of Standard Stoker Co. (280)
Scientific Glass Apparatus Co., Inc. (215, 217, 219)
Sprout, Waldron & Co. (550–553)
Turbo-Mixer Corp. (285–287)
Will Corp. (667–668)

AIR CONDITIONING APPARATUS
Cargocaire Engineering Corp. (621)
Davison Chemical Corp. (622–624)
Grove Regulator Co. (640D)
W. A. Hammond Drierite Co. (266)
Niagara Blower Co. (233–235)
Worthington Pump & Machinery Corp. (319–321)

AIR TABLES
Separations Eng. Corp. (52)

ALCOHOL
Carbide & Carbon Chemicals Corp. (17–18)
Commercial Solvents Corp. (55)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Sharples Chemicals, Inc. (25–25A)
U. S. Steel Corp. (76–77)
Will Corp. (667–668)

ALKALIES
Carbide & Carbon Chemicals Corp. (17–18)
Eimer & Amend (57)
Fischer Scientific Co. (57)
U. S. Steel Corp. (76–77)
Will Corp. (667–668)

ALLOYS FERROUS
Carpenter Steel Co. Alloy Tube Div. (491–492)
Duriron Co., Inc., The (19–20)
Foote Mineral Co., Inc. (607–608)
General Alloys Co. (299)
Lukens Steel Co.—By-Products Steel Corp. Div. (558–563)
Republic Steel Corp. (434–436)
Titanium Alloy Mfg. Co. (366–368)
Will Corp. (667–668)

ALLOYS—NON-FERROUS
Aluminum Co. of America (70–71)
Ampco Metal, Inc. (268)
Fansteel Metallurgical Corp. (282 284)
Haynes Stellite Co. (92)
International Nickel Co. (9–10)
D. E. Makepeace Co. (453)
National Lead Co. (247)
Republic Filters, Inc. (556–557)
Titanium Alloy Mfg. Co. (366–368)
Will Corp. (667–668)

ANODES
Aluminum Co. of America (70–71)
American Platinum Works (456)
Baker & Co., Inc. (451–452)
Coleman Instrument, Inc. (381–381A) anoixia photometer
Heil Process Equipment Corp. (575)
Knapp Mills, Inc., Andrews-Knapp Construction Co., Inc. (23) lead
D. E. Makepeace Co. (453)
National Lead Co. (247)
U. S. Stoneware Co., The (89–91)
Will Corp. (667–668)

ASBESTOS
Alsop Engineering Corp. (293) neutral filter pads
Bramley Machinery Corp. (524–525) mixers
Eimer & Amend (57)
Fischer Scientific Co. (57)
Garlock Packing Co. (244)
Haveg Corp. (51)
Hercules Filter Corp. (443–445)
Munn & Steele, Inc. (406)
Republic Filters, Inc. (556–557)
Will Corp. (667–668)

AUTOCLAVES
Aetna Scientific Co. (218)
American Instrument Co. (385–387)
Artisan Metal Products, Inc. (540–542)
Bartlett & Snow Co., C. O. (427–428)
Black, Sivalls & Bryson, Inc. (496)
Blaw-Knox Div. of Blaw-Knox Co. (13–14)
S. Blickmann, Inc. (474–475)
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Haveg Corp. (51)
Industrial Process Engineers (441)
Knapp Mills, Inc., Andrews-Knapp Construction Co., Inc. (23) lead-lined
L. O. Koven & Bro., Inc. (304–306)
National Lead Co. (247)
Ohio Chemical & Mfg. Co., The (216) laboratory
Palo Myers, Inc. (642)
Perfektum Products Co. (209–211)

(*Continued on page* 320)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

INSTRUMENTS FOR MEASUREMENT AND CONTROL OF GASES · LIQUIDS · STEAM · AIR

YOU ARE CORDIALLY INVITED

TO VISIT OUR EXHIBIT AT BOOTHS 39 · 40 · 41

TWENTY-FIRST EXPOSITION OF CHEMICAL INDUSTRIES
GRAND CENTRAL PALACE · NEW YORK · DECEMBER 1-6

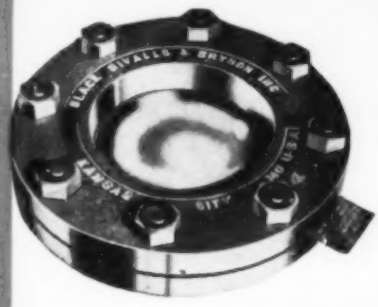
where you will find a complete and interesting display of Flow Controllers, Recording and Integrating Orifice Meters, Indicating Flow Meters, Pneumatic Transmitters and Receivers, Base Volume Index, Ironcase and Tinned Steelcase Displacement Meters, Dry and Wet Test Meters, Reliance Regulators, Miscellaneous Equipment.

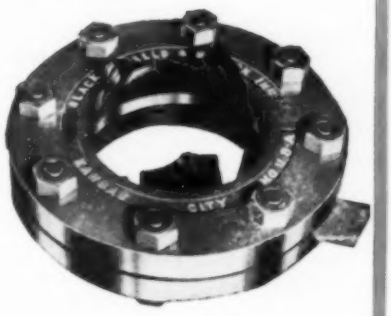
AMERICAN METER CO
EST. 1836
MEASUREMENT ENGINEERS
TRADE MARK REG.

AMERICAN METER COMPANY

INCORPORATED (ESTABLISHED 1836)

Albany · Atlanta · Baltimore · Birmingham · Boston
Chicago · Dallas · Denver · Erie · Houston · Joliet
Kansas City · Los Angeles · New York · Orlando
Philadelphia · Pittsburgh · San Francisco · Tulsa



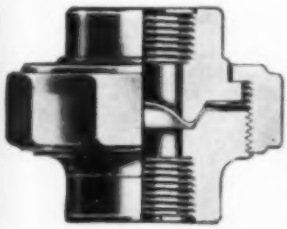


SAFETY HEADS

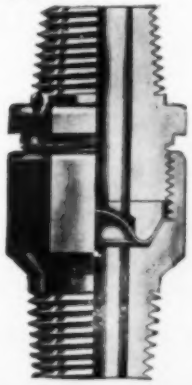
(Pressure Relief Discs)

Wherever you employ pressure, you need Black, Sivalls & Bryson SAFETY HEADS. There's a size and type for every situation, engineered for the job, as the needs require. Metal disc breaks in tension at pre-determined pressure and temperature. No other pressure relief device offers such complete protection with such economy . . . none can approach the relief capacity of a SAFETY HEAD in a given diameter. SAFETY HEADS are built for a specific job . . . pressure relief. No pressure vessel equipped with a SAFETY HEAD has ever burst from overpressure!

Simple . . . Versatile . . . Sure



Pressures up to 25,000 psi, liquids or gases, are handled in perfect safety. SAFETY HEADS act instantly, provide full pipe-size unrestricted relief opening. No working parts.



Quickly installed, discs are easily replaced. Rupture discs are guaranteed to burst within five per cent of specified pressure at stated temperature!

EFFICIENCY BS&B RELIABILITY

Mark of Merit

for Over 54 Years!

Since its founding in 1893, Black, Sivalls & Bryson has maintained but one standard ... quality products and superior craftsmanship. Step by step, the constant growth to its present hemispheric proportion has proved this policy the wisest possible. Now, and into the future, this same rigorous and unyielding responsibility to our customers will be maintained. The seal of BS&B will continue to be a Mark of Merit !

WRITE for Latest CATALOG

Prepared to give you all the facts about B S & B Chemical Feeders, Vent Valves and SAFETY HEADS. Complete descriptions, specifications, photos, diagrams. Address Special Products Division, Black, Sivalls & Bryson, Inc., Power and Light Building, Kansas City 6, Missouri.

FOREIGN INQUIRIES INVITED — Cable Address: BLACK, KANSAS CITY, U.S.A.

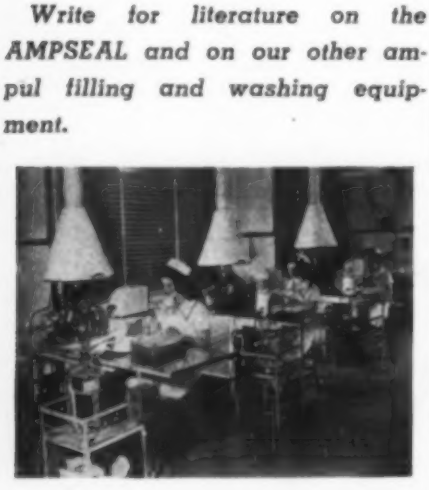
EFFICIENCY BLACK, SIVALLS & BRYSON, INC. RELIABILITY

KANSAS CITY, MO. — OKLAHOMA CITY, OKLA.

The PerfeKtum AMPSEAL

A semi-automatic ampul and tube sealing machine which provides superior sealing at a rate vastly exceeding that of hand production. It employs the proper technique for a perfect and full seal. Ampuls ranging from 1 cc through 20 cc may be sealed at rates up to 4,000 per hour. The AMPSEAL can be prepared to handle all types of ampuls in the above mentioned size range.

Write for literature on the AMPSEAL and on our other ampul filling and washing equipment.



• Illustration above shows Perfektum equipment as installed in the laboratories of the Ciba Company.

PerfeKtum

PRODUCTS COMPANY

Serving Industry for 25 Years

300 Fourth Avenue New York 10, N. Y.

Pfaudler Co., The (72–73)
Standard Scientific Supply Corp. (618)
Welding Engineers, Inc. (407–408)
Will Corp. (667–668)

AUTOMATIC TEMPERATURE CONTROL

American Instrument Co. (385–387)
Bailey Meter Co. (274–276)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Electric Hotpack Co., Inc. (655–656)
Emil Greiner Co., The (226–228)
Leslie Co. (676)
Process & Instruments (518)
Sarco Co., Inc. (11)
Will Corp. (667–668)

BAGS

Bemis Bro. Bag Co. (338–340)
Fulton Bag & Cotton Mills (424)
St. Regis Sales Corp. (531–532) paper
Union Bag & Paper Corp. (459–460) paper

BALANCES & WEIGHTS

Emil Greiner Co., The (226–228)
Gamma Scientific Co. (497)
Palo Myers, Inc. (642)
Seederer-Kohlbusch, Inc. (389)
Standard Scientific Supply Corp. (618)
Will Corp. (667–668)
W. M. Welch Scientific Co. (405)

BARRELS, DRUMS & KEGS

Aluminum Co. of America (70–71)
Associated Cooperage Industries of America, Inc. (242)
Carpenter Container Corp. (261)
Container Co. Div., The Continental Can Co., Inc. (243–245)
Knapp Mills, Inc., Andrews-Knapp Construction Co., Inc. (23)
Maurice A. Knight Co. (53) all rubber
Pressed Steel Tank Co. (348–352)
Republic Steel Corp. (434–436)
U. S. Steel Corp. (76–77)

BASKETS—DIPPING

General Alloys Co. (299)
Haveg Corp. (51)
Heil Process Equipment Corp. (575)
Maurice A. Knight Co. (53) stoneware
Luzerne Rubber Co. (528–529)
U. S. Stoneware Co., The (89–91)

BEARINGS

Ampco Metal, Inc. (268)
Great Western Mfg. Co. (372–374)
Haveg Corp. (51)
National Lead Co. (247)
Reeves Pulley Co. of N. Y., Inc. (34)
Sprout, Waldron & Co. (550–553)

BELTS

Allis-Chalmers Mfg. Co. (48–49)
Baldwin Belting, Inc. (662)
Great Western Mfg. Co. (372–374)
Reefes Pulley Co. of N. Y., Inc. (34)
Worthington Pump & Machy. Corp. (319–321)

BLAST EQUIPMENT SAND

Dust & Fume Control Division American Wheelabrator & Equipment Corp. (481–484)
Norton Co. (415–416) blocks, air-cooled

BLOWERS (STATE KIND)

Allis-Chalmers Mfg. Co. (48–49) centrifugal
Eclipse Fuel Eng. Co. (504) combustion
Ingersoll-Rand Co. (615–617) tubs
Metalab Equip. Corp. (462–464) laboratory
Schutte-Koerting Co. (291) jet
Will Corp. (667–668)

BOILERS

Eclipse Fuel Eng. Co. (504) gas fired
% Proportioneers, Inc. % (477–478)

BOILER COVERING & INSULATION

Johns-Manville Corp. (93–94)
Munn & Steele, Inc. (406)
Owens-Corning Fiberglas Corp. (437–439)
Permutit Co., The (400) boiler feed water treatment
% Proportioneers, Inc. % (477–478)

BOLTING CLOTH

Great Western Mfg. Co. (372–374)
Newark Wire Cloth Co. (83–84)
Richmond Mfg. Co. (519)
Sprout, Waldron & Co. (550–553)
The W. S. Tyler Co. (88)

BOOKS

Interscience Publishers, Inc. (467)
McGraw-Hill Book Co. (283)
Reinhold Publishing Co. (26–27)
Van Nostrand Co., Inc., D. (85)

BOTTLING MACHINERY

Ertel Engineering Corp. (508–509)
Horix Mfg. Co. (413–414)
Karl Kiefer Machine Co., The (24)
Metal-Glass Products Co. (425–426)
M. R. M. Co., Inc. (638)
Perl-Oussani Machine Mfg. Co. (604)
Pneumatic Scale Corp., Ltd. (22)

BRICK—ACID PROOF

Electro Chemical Supply & Engineering Co. 81)
General Ceramics & Steatite Corp. (2)
Heil Process Equip. Corp. (575)
Maurice A. Knight
National Carbon Co., Inc. (30–31)
U. S. Stoneware Co., The (89–91)

BRICK—INSULATING

Johns-Manville Corp. (93–94)
U. S. Stoneware Co., The (89–91)

BRICK, REFRACTORY

Bramley Machinery Corp. (524–525)
Johns-Manville Corp. (93–94)
Munn & Steele, Inc. (406)
National Carbon Co., Inc. (30–31)
Norton Co. (415–416)
Titanium Alloy Mfg. Co. (366–368)
U. S. Stoneware Co., The (89–91)

BRIQUETTING & TABLET MAKING MACHINERY

Fred S. Carver, Inc. (237)
F. J. Stokes Machine Co. (80)

BUCKETS, ELEVATOR

Bartlett & Snow Co., C. O. (427–428)
Denver Equipment Co. (507)
Great Western Mfg. Co. (372–384)
B. F. Gump Co. (362–364)

(*Continued on page* 321)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

EXHIBITORS
Classified by Products
CONTINUED

Jeffrey Mfg. Co. (44a–45)
Omega Machine Co. (480)
Read Machinery Div. of Standard Stoker Co. (280)
Sprout, Waldron & Co. (550–553)

BUILDING MATERIALS
Electro Chemical Supply & Engineering Co. (81) acid proof
Johns-Manville Corp. (93–94)
Knapp Mills, Inc., Andrews-Knapp Construction Co., Inc. (23)
Munn & Steele, Inc. (406)
National Lead Co. (247)
Owens-Corning Fiberglas Corp. (437–439)
U. S. Steel Corp. (76–77)

BURNERS
Eclipse Fuel Eng. Co. (504) gas
Eimer & Amend (57).
Fischer Scientific Co. (57)
Hoke, Inc. (213)
Schutte & Koerting Co. (291) oil
Selas Corp. of America (533–534)
Will Corp. (667–668)

CABINETS—CHEMICAL FILING & LABORATORY
Eimer & Amend (57)
Fischer Scientific Co. (57)
Falstrom Co. (510–511) steel
Kewaunee Mfg. Co. (308–310)
Knapp Mills, Inc., Andrews-Knapp Construction Co., Inc. (23)
Laboratory Furniture Co., Inc. (221–223)
Metalab Equipment Corp. (462–464)
Republic Steel Corp. (434–436)
E. H. Sheldon & Co. (255)
John E. Sjostrom Co. (664)
Technicon Co., The (640B)
W. M. Welch Scientific Co. (405)
Will Corp. (667–668)

CALCINERS
Bartlett & Snow Co., C. O. (427–428)
Dorr Co., The (64–65)
General American Transportation Corp. (285–287)
Hardinge Co., Inc. (60)

CALORIMETERS
American Meter Co. (39–41)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Scientific Glass Apparatus Co., Inc. (215, 217, 219)
W. M. Welch Scientific Co. (405)
Will Corp. (667–668)

CANS
Container Co. Div., The Continental Can Co. (243–245)

CARBON
Bramley Machinery Corp. (524–525) mixers
Carbide & Carbon Chemicals Corp. (17–18)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Heil Process Equipment Corp. (575) heating units
National Carbon Co., Inc. (30–31)

(*Continued on page* 322)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

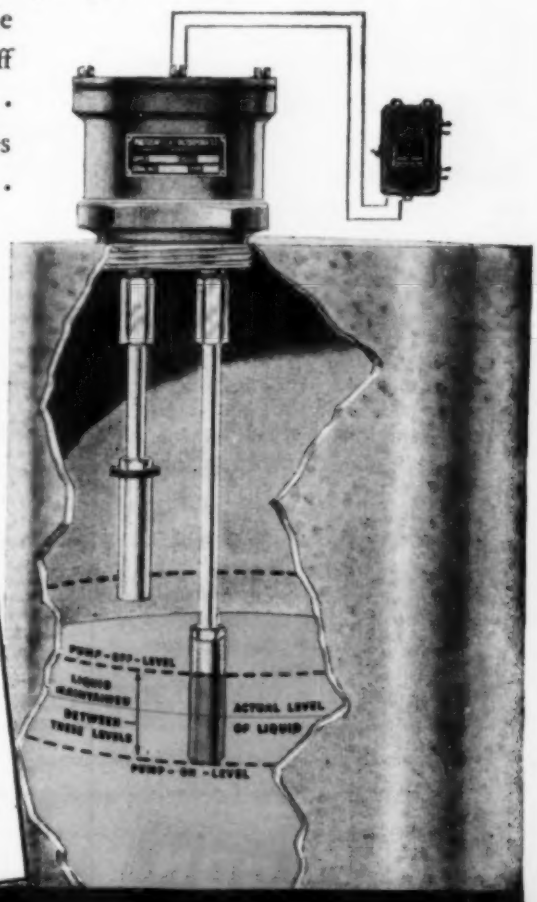
NEW PHOTOSWITCH LEVEL CONTROL

Type 10CB1 Level Control outperforms all other level controls. It accurately maintains *predetermined* levels for liquids or powders. Extensively used for control of water, milk, beer, acids, caustics and most other chemicals in Chemical Process, Food and Sewage fields when the ultimate in control is desired. Special fittings for sanitary installations meet all health board requirements.

The unique principle of Photoswitch design permits contact with liquid under control only by stainless steel probe rods. No floats or other moving parts required. Accuracy independent of temperature and pressure. Low voltage A.C. in probe circuit prevents electrolytic action. Yet amplification through power circuit gives positive control of signals, valves or pumps.

Use Type 10CB1 for single level indication • on-and-off pumping • boiler feed water • boiler condensate • all types of pump programming • The most generally adaptable level control available.

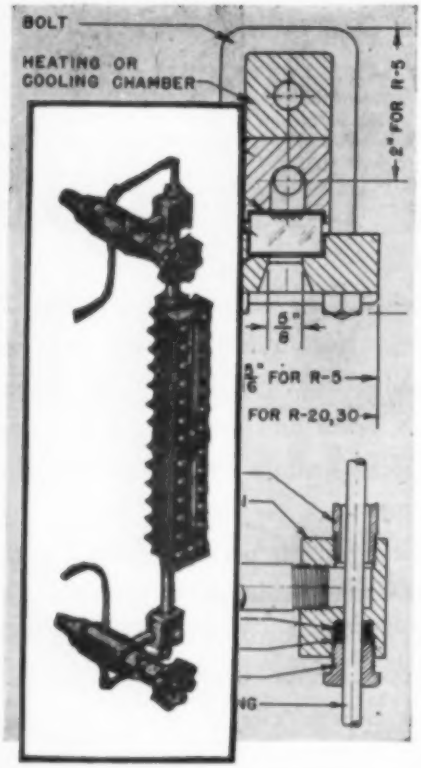
Send for bulletin #201P.



MAINTENANCE—FREE

- NO MOVING PARTS
- NO FLOATS
- NO STUFFING BOXES
- NO BELLOWS SEALS
- NO VACUUM TUBES
- NO MAINTENANCE

PHOTOSWITCH
INCORPORATED
Photoelectric & Electronic Controls for Every Industrial Purpose
77 BROADWAY CAMBRIDGE 42, MASS.



JERGUSON HEATED AND COOLED GAGES

Give Accurate Readings Under All Conditions

USE Jerguson Heated Gages for accuracy if you are dealing with high viscosity liquids that flow sluggishly.

On the other hand, if you are dealing with highly volatile liquids which tend to boil, use Jerguson Cooled Gages with circulating cooling medium.

In either case, Jerguson engineers have the answer, with a complete line of gages that give accurate reading of *all* liquids under *all* temperature conditions.

Jerguson Heated-Cooled Gages are made in internal tube and double chamber models for all pressures.

Illustration shows Internal Tube Model, Reflex Type, with No. 93 Valves. Write for Data Unit No. 17.

JERGUSON
GAGE & VALVE COMPANY
100 Fellsway, Somerville 45, Mass.
Representatives in Major Cities
Phone Listed Under JERGUSON

EXHIBITORS • Classified by Products • CONTINUED

CARBOY TILTERS
Barrett-Cravens Co. (239)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Metalab Equipment Corp. (462–464)
Will Corp. (667–668)

CARS—TANKS
American Hard Rubber Co. (303–305)
Knapp Mills, Inc., Andrews-Knapp Construction Co., Inc. (23)
General American Transportation Corp. (285–287)
Tank Car Div.—General American Transportation Corp. (285–287)

CASTINGS (STATE KIND)
Allegheny Ludlum Steel Corp. (250–252–254) stainless
Aluminum Co. of America (70–71) aluminum
Ampco Metal, Inc. (268) bronze
Buflovak Equipment Div. of Blaw-Knox Co. (6) gray iron
Cooper Alloy Foundry Co., The (565–566) stainless steel
General Alloys Co. (299) stainless steel
Goslin Birmingham Mfg. Co., Inc. (74) chemical industry
Grinnell Co., Inc. (251) all kinds
Haynes Stellite Co. (92)
Hercules Filter Corp. (443–445) filter
Hills McCanna Co. (346) magnesium
Industrial Steels, Inc. (650) stainless steel
International Nickel Co. (9–10) nickel & nickel alloy
Knapp Mills, Inc., Andrews-Knapp Construction Co., Inc. (23) lead
Lebanon Steel Foundry (465–466) stainless, corrosion & acid resisting alloy
Norton Co. (415–416) catalyst supports
Sprout, Waldron & Co. (550–553) white iron

CARS—FREIGHT
Tank Car Div.—General American Transportation Corp. (285–287)

CAUSTIC POTS
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Goslin Birmingham Mfg. Co., Inc. (74)
Industrial Steels, Inc. (650) stainless steel
L. O. Koven & Bro., Inc. (304–306)
Lukens Steel Co.—By-Products Steel Corp. Div. (558–563)

CELLULOSE
Hercules Powder Co., Inc. (W Part of 7)

CEMENT (STATE KIND)
Electro Chemical Supply & Eng. Co. (81) acid & alkali proof
General Ceramics & Steatite Corp. (2) acid proof
Haveg Corp. (51)
Johns-Manville Corp. (93–94) insulating, refractory
Maurice A. Knight (53)
Norton Co. (415–416)
Owens-Corning Fiberglas Corp. (437–439) insulating
Titanium Alloy Mfg. Co. (366–368)
U. S. Stoneware Co., The (89–91) acid proof
Will Corp. (667–668)

CENTRIFUGALS
American Tool & Machine Co. (412)
Baker Perkins, Inc. (62–63)
Bird Machine Co. (535–536, 543–544)
Delaval Separator Co., The (323)
Denver Equipment Co. (507)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Fletcher Works, Inc. (5)
Palo Myers, Inc. (642)
Sharples Corp., The (58–59)
Scientific Glass Apparatus Co., Inc. (215, 217, 219)
Standard Scientific Supply Corp. (618) laboratory
Tolhurst Centrifugals Div., American Machine & Metals, Inc. (68–69)
W. M. Welch Scientific Co. (405)
Will Corp. (667-668)

CERAMICS
Bramley Machinery Corp. (524–525)
Foote Mineral Co., Inc. (607–608)
General Ceramics & Steatite Corp. (2)
Great Western Mfg. Co. (372–374)
Illinois Electric Porcelain Co. (672–673)
Maurice A. Knight Co. (53)
Lapp Insulator Co., Inc. (500–501)
Selas Corp. of America (533–534)
Socony-Vacuum Oil Company, Inc. (324–326)
U. S. Stoneware Co., The (89–91)

CHEMICAL STONEWARE ACID PROOF
Eimer & Amend (57)
Fischer Scientific Co. (57)
Fansteel Metallurgical Corp. (282–284)
General Ceramics & Steatite Corp. (2)
Illinois Electric Porcelain Co. (672–673)
Johns-Manville Corp. (93–94)
Kewaunee Mfg. Co. (308–310)
Maurice A. Knight Co. (53)
Laboratory Furniture Co., Inc. (221–223)
Metalab Equipment Corp. (462–464)
Monarchy Mfg. Works, Inc. (354)
U. S. Stoneware Co., The (89–91)
Will Corp. (667-668)

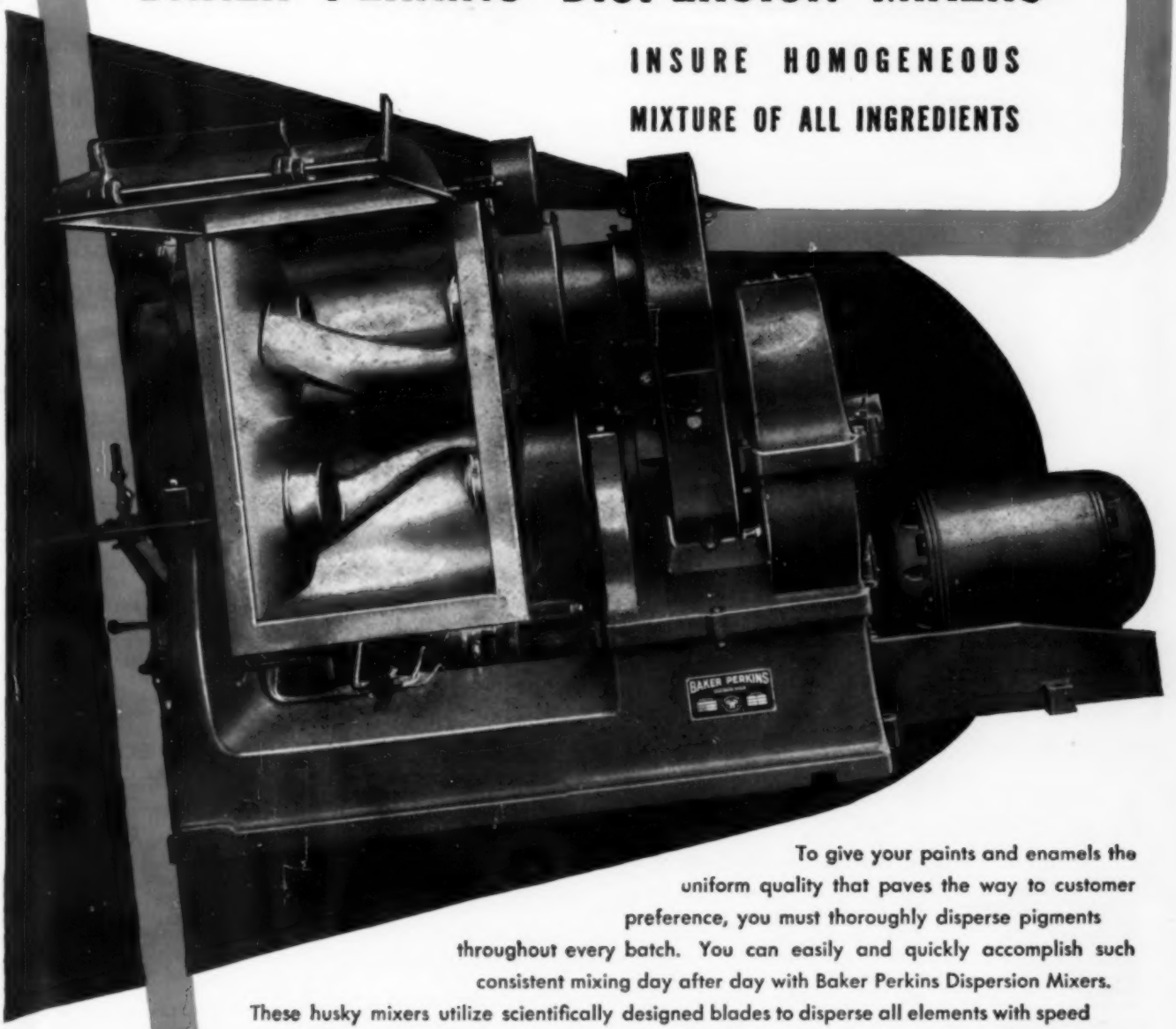
CHEMICALS, INDUSTRIAL
Aluminum Co. of America (70–71)
Alrose Chemical Co. (490)
American Resinous Chemicals Corp. (35–36)
Ansul Chemical Co. (82) sulfur dioxide—methyl chloride
Atlas Powder Co. & Darco Corp. subsidiary (46–47)
Carbide & Carbon Chemicals Corp. (17–18)
Commercial Solvents Corp. (55)
Davison Chemical Corp., The (622–624)
Evans Chemetics, Inc. (461)
Foote Mineral Co., Inc. (607–608)
General Aniline & Film Corp. (619–620)
Glyco Products Co., Inc. (225–227)
W. A. Hammond Drierite Co. (266)
Hardesty Chemical Co., Inc. (628–649)
Hercules Powder Co., Inc. (W Part of 7)
Koppers Co., Inc. (264)
Magnus, Mabee & Reynard (498)
Metalsalts Corp. & Darsyn Laboratories (470) metallic mercury, mercurial salts
Neville Co. (547–548)

(*Continued on page* 324)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

BAKER PERKINS DISPERSION MIXERS

INSURE HOMOGENEOUS MIXTURE OF ALL INGREDIENTS



To give your paints and enamels the uniform quality that paves the way to customer preference, you must thoroughly disperse pigments throughout every batch. You can easily and quickly accomplish such consistent mixing day after day with Baker Perkins Dispersion Mixers. These husky mixers utilize scientifically designed blades to disperse all elements with speed and thoroughness that cannot be duplicated by ball mills, grinding mills, or roll mills. Illustrated in discharge position is just one type in the complete Baker Perkins line—the Size 15 Type VUMM Dispersion Mixer, with 2 speed, 100 HP motor. For homogeneous dispersion of pigments, it will pay you to use a B-P Dispersion Mixer . . . preferred by many paint and enamel manufacturers whose products have a reputation for unvarying quality. For the best answer to all your mixing problems, consult the Baker Perkins Sales Engineer in your area or write direct to Baker Perkins Inc., Chemical Machinery Division, Saginaw, Mich.

Baker Perkins Inc.
SAGINAW • MICHIGAN

. . . here's the story:

A FEW OF MANY PRODUCTS THAT CAN BE FILTERED WITH SPARKLERS

Acids
Alcohols
Alkalis
Beverages
Candy scrap
Caustics
Chemicals
Cleaning fluids
Extracts
Flavors
Gums
Hydraulic fluids
Lubricants
Milk
Molasses
Oils
Pharmaceuticals
Plating solutions
Resins
Shellacs
Soap, liquid
Syrups
Varnishes
Water
Wines

★ Sparkler Horizontal Plate Filters handle any liquid from heavy varnishes to light alcohols.

★ Equally efficient performance on intermittent or continuous operation, under a wide range of temperature, pressure and viscosity conditions.

★ Equally effective whether removing carbons and contact clays or clarifying and polishing with filter aids.

★ Patented Scavenger Plate permits *complete* batch filtration. (It's virtually an auxilliary filter with an independent control valve.)

★ Unexcelled filter cake stability — no slipping or breaking.

. . . why?

Because filter media are supported on a horizontal plane and filter aids floated into position uniformly; filtration takes place uniformly over entire filtering areas. Flow through filter is always *with* gravity.

Sparkler Filtration Is *Engineered* Filtration—we invite correspondence on your problem. You will receive the advice of filtration scientists with a quarter of a century of experience in a specific field.

SPARKLER MANUFACTURING COMPANY
MUNDELEIN, ILLINOIS

EXHIBITORS Classified by Products CONTINUED

Chas. Pfizer & Co., Inc. (5)
Reichhold Chemicals, Inc. (651–654)
Sharples Chemicals, Inc. (25–25a)
Sheffield Farms Co., Inc. (505)
Socony-Vacuum Oil Company, Inc. (324–326)
W. M. Welch Scientific Co. (405)
Winthrop-Stearns, Inc. (430)

CHEMICALS—LABORATORY

Ansul Chemical Co. (82) sulfur dioxide —methyl chloride
Carbide & Carbon Chemicals Corp. (17–18)
Commercial Solvents Corp. (55)
Davison Chemical Corp., The (602–624)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Evans Chemetics, Inc. (461)
Foote Mineral Co., Inc. (607–608)
Foster D. Snell, Inc. (37)
W. A. Hammond Drierite Co. (266)
Metalsalts Corp. & Darsyn Laboratories (470) oxyquinoline base & derivatives
Palo Myers, Inc. (642)
Scientific Glass Apparatus Co., Inc. (215, 217, 219)
Standard Scientific Supply Corp. (618)
W. M. Welch Scientific Co. (405)
Will Corp. (667-668)

CHEMICALS—PHARMECEUTICAL

Evans Chemetics, Inc. (461)
Magnus, Mabee & Reynard, Inc. (498)
Chas. Pfizer & Co., Inc. (5)
Scientific Glass Apparatus Co., Inc. (215, 217, 219)
Sheffield Farms Co., Inc. (505)
Will Corp. (667-668)

CHEMICAL PLANT EQUIPMENT

American Hard Rubber Co. (303–305) rubber lined
Artisan Metal Products, Inc. (540–542)
Allis-Chalmers Mfg. Co. (48–49)
Aluminum Co. of America (70–71)
American Tool & Machine Co. (412)
Amersil Co., Inc. (454)
Baker Instrument Co. (640C)
Bartlett & Snow Co., C. O., (427–428)
Black, Sivalls & Bryson, Inc. (496)
Blaw-Knox Div. of Blaw-Knox Co. (13–14)
S. Blickman, Inc. (474-475)
Bramley Machinery Corp. (524–525)
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Fred S. Carver, Inc. (237)
Chemicolloid Labs, Inc. (257)
Cornell Machine Co., The (633)
Cowles Co., Inc., The (572)
Davison Chemical Corp., The (622–624)
Denver Equipment Co. (507)
Dorr Co., The (64–65)
Duriron Co., Inc., The (19–20)
Eimco Corp., The (605–606)
Electro Chemical Supply & Engineering Co. (81)
Eppenbach, Inc. (289)
Eriez Mfg. Co. (631)
Fansteel Metallurgical Corp. (282–284)

(*Continued on page 327*)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

EXHIBITORS • Classified by Products • CONTINUED

W. J. Fitzpatrick Co., The (401–402)
Filtration Engineers, Inc. (8)
General American Transportation Corp. (285–287)
General Ceramics & Steatite Corp. (2)
Goslin Birmingham Mfg. Co., Inc. (74)
General Electric Co. (4)
Glascote Products, Inc. (657–658)
Great Western Mfg. Co. (372–374)
B. F. Gump Co. (362–364)
Haveg Corp. (51)
Heil Process Equipment Corp. (575)
Hills McCanna Co. (346)
Illinois Electric Porcelain Co. (672–673)
Industrial Process Engineers (441)
Jeffrey Mfg. Co. (44A–45)
Knapp Mills, Inc. & Andrews-Knapp Construction Co., Inc. (23) lead
Maurice A. Knight Co. (53)
L. O. Koven & Bro., Inc. (304–306)
Labour Co., Inc., The (32)
Lapp Insulator Co., Inc. (500–501)
Lukens Steel Co.—By-Products Steel Corp. Div. (558–563)
Luzerne Rubber Co. (528–529)
Marco Co., Inc. (646-647)
Metal-Glass Products Co. (425–426)
Micro Metallic Corp. (671)
Mixing Equipment Co., Inc. (307–309, 334–336)
M. R. M. Co., Inc. (638)
National Carbon Co., Inc. (30–31)
National Engineering Co. (554–555)
National Lead Co. (247)
New England Tank & Tower Co. (50)
Omega Machine Co. (480)
Perkin-Elmer Corp., The (442)
Pfaudler Co., The (72–73)
Premier Mill Corp. (312–314)
Photoswitch, Inc. (603)
Pressed Steel Tank Co. (348–352)
Proctor & Schwartz, Inc. (15)
Productive Equipment Corp. (549)
% Proportioneers, Inc. % (477–478)
Read Machinery Div. of Standard Stoker Co. (280)
Republic Filters, Inc. (556–557)
Richmond Mfg. Co. (519)
Schutte & Koerting Co. (291)
Seederer-Kohlbusch, Inc. (389)
Sprout, Waldron & Co. (550–553)
F. J. Stokes Machine Co. (80)
Sturtevant Mill Co. (3)
Syntron Co. (311–313)
Tolhurst Centrifugals Div., American Machine & Metals, Inc. (68–69)
Trent, Inc. (526–527)
U. S. Stoneware Co., The (89–91)
Welding Engineers, Inc. (407–408)
Will Corp. (667–668)

CHEMISTS
Evans Chemetics, Inc. (461)
Evans Research & Development Corp. (489)
Foster D. Snell (37) consultant, analytical, research

CHLORINATORS
General Ceramics & Steatite Corp. (2)
Glascote Products, Inc. (657–658)
Haveg Corp. (51)
L. O. Koven & Bro., Inc. (304–306)
Lapp Insulator Co., Inc. (500–501)
Milton Roy Co. (432–433)
% Proportioneers, Inc. % (477–478)
U. S. Stoneware Co., The (89–91)
Wallace & Tiernan (520–521)

CLARIFIERS
American Tool & Machine Co. (412)
Bird Machine Co. (535–536, 543–544)
Dorr Co., The (64–65)
Denver Equipment Co (507)
Fletcher Works, Inc. (33)
General American Transportation Corp. (285–287)
Hardinge Co., Inc. (60)
Hercules Filter Corp. (443–445)
Oliver United Filters, Inc. (65–66)
Republic Filters, Inc. (556–667)
Sharples Corp., The (58–59)
Sparkler Mfg. Co. (516–517)
Tolhurst Centrifugals Div., American Machine & Metals, Inc. (68–69)

CLASSIFIERS
Bird Machine Co. (535-536, 543-544)
Denver Equipment Co. (507) hydraulic, Hydro, rake spiral
Dorr Co., The (64–65)
Federal Classifier Systems, Inc. (404) air
Hardinge Co., Inc. (60)
Richmond Mfg. Co. (519)
Ritter Products Corp. (Electrostatic) (56)
Sharples Co., The (58–59)
Sturtevant Mill Co. (3)

CLUTCHES
Hardinge Co., Inc. (60)
Kinney Mfg. Co. (468–469)

COAL TAR OILS
Koppers Co., Inc. (264)
Neville Co. (547–548)
U. S. Steel Corp. (76–77)
Will Corp. (667–668)

COATINGS—PROTECTIVE
American Hard Rubber Co. (303–305)
Atlas Powder Co. & Darco Corp. subsidiary (46–47)
Commercial Solvents Corp. (55)
Davison Chemical Corp., The (622–624)
Electro Chemical Supply & Engineering Co. (81)
General Aniline & Film Corp. (619–620)
Haveg Corp. (51)
Heil Process Equipment Corp. (575)
Kewaunee Mfg. Co. (44A–45)
Knapp Mills Inc., & Andrews-Knapp Construction Co., Inc. (23)
Maurice Knight Co. (53)
Koppers Co., Inc. (264)
Lukens Steel Co.—By-Products Steel Corp. (558–563)
Luzerne Rubber Co. (528–529)
Magna Mfg. Co., Inc. (609)
National Lead Co. (247)
Petroleum Specialties, Inc. (471)
L. Sonneborn Sons, Inc. (471)

COILS
General Ceramics & Steatite Corp. (2)
Knapp Mills, Inc. & Andrews-Knapp Construction Co., Inc. (23)
National Lead Co. (247)
Parker Appliance Co. (21) tubing
John A. Roebling's Sons, Inc. (358–360)

COKE OVEN MACHINERY
Koppers Co., Inc. (264)

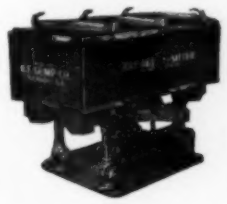
COLLECTORS
Federal Classifier Systems, Inc. (404) dust
Hardinge Co., Inc. (60)
Pulverizing Machine Co. (300–302)
Richmond Mfg. Co. (519)

(*Continued on page* 329)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

SEE THIS Chemical Processing Equipment

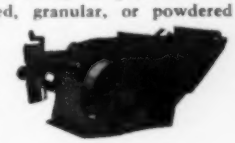
BAR-NUN ROTARY SIFTERS



Modern, large capacity sifters with complete rotary motion, "mechanically controlled". Provide thorough separations. Furnished with one, two, or three screens, to deliver two, three, or four sizes of product in grading, scalping, or sifting applications.

DRAVER FEEDERS

Accurate feeding, by volume, of predetermined amounts of dry, flaked, granular, or powdered material. Close control of feeding rates. Also used for continuous mixing systems. Over 100 sizes and models.



VIBROX PACKERS

Efficient, smooth-running, vibrating-rocking packers which usually repay their own costs in a short time through reduction of labor, handling, and container costs. Available in five sizes for container capacities from 5 to 750 pounds.

AUTOMATIC NET WEIGHERS

Bar-Nun "Auto-Check" Automatic Net Weighers and Edtbauer-Duplex Automatic Net Weighers for extremely accurate net weights in ranges between 3 ounces and 75 pounds. For dry, free flowing and semi-free flowing materials.

75TH YEAR

Gump Engineers, backed by 75 years' experience in processing dry, flaked, granular and powdered materials, will be glad to work with you in selecting the Gump-Built Equipment best suited to your specific requirements.

CHEMICAL EXPOSITION
BOOTH NOS. 362-364

B. F. GUMP CO.
Established 1872
422 South Clinton Street, Chicago 7, Illinois
Engineers and Manufacturers since 1872

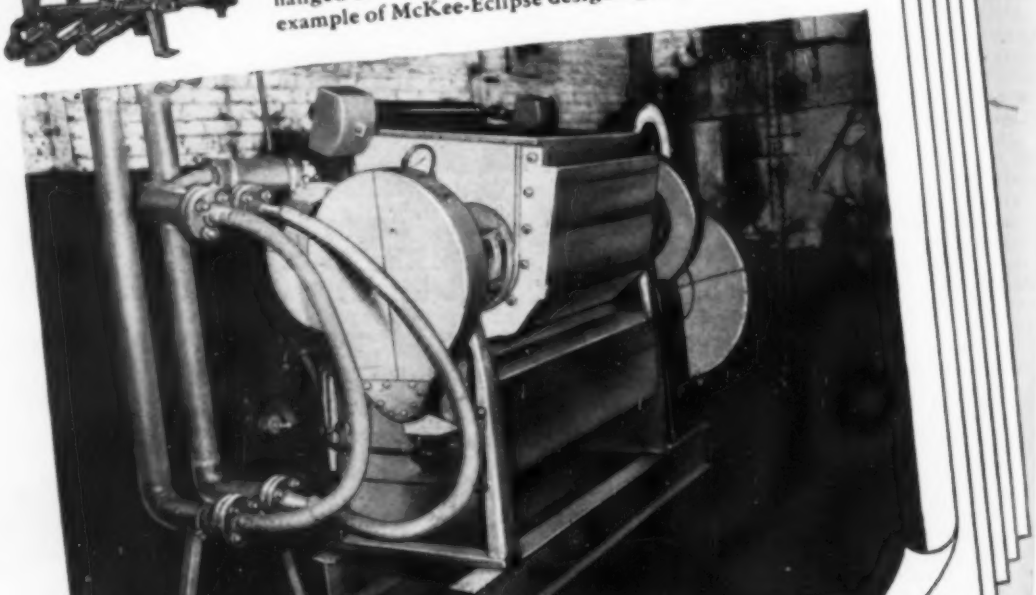
ESPECIALLY DESIGNED for DOWTHERM

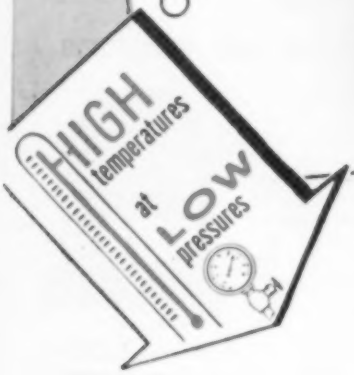
Th McKee Dowtherm Vaporizer is not just a boiler using Dowtherm. It's definitely designed and engineered *for* Dowtherm, *in addition* to having the economy and heating efficiency advantages of McKee Automatic All-in-One-Package Boilers — and has back of it over 13 years of satisfying performance.

Heating Jacketed Mixer

If you have any application, heating a jacketed mixer (or other process requiring high temperatures) investigate the low pressure advantages of McKee Dowtherm Vaporizers.

Note in the illustration, the use of seamless, flexible flanged-end hose, absolutely eliminating leakage, another example of McKee-Eclipse designing to fit the specific job.





HUNDREDS of McKee Dowtherm Vaporizers are being used because of their dependable, long-term ability to develop high temperature at low pressure — and *low cost* — preventing local overheating, discoloration, burning or scorching.

Representatives in the following cities:

Albuquerque, N. M.
Atlanta, Georgia
Boston 16, Massachusetts
Buffalo 17, New York
Chicago 3, Illinois
Cincinnati 6, Ohio
Cleveland, Ohio
Detroit 19, Michigan
Houston 4, Texas
Kansas City, Missouri
Los Angeles 11, California
New Orleans, Louisiana
New York 7, N. Y.
Philadelphia, Pennsylvania
Pittsburgh, Pennsylvania
Portland, Oregon
St. Louis, Missouri
San Francisco, California
Tulsa 3, Oklahoma
Wallingford, Connecticut

Eclipse Fuel Engineering Company
ROCKFORD ILLINOIS

McKee Eclipse

EXHIBITORS
Classified by Products
CONTINUED

Claude B. Schneible Co. (421–422) dust, fume
Sprout, Waldron & Co. (550–553)
Technicon Co., The (640B)
Wright Austin Co. (461-A)

COLLOID MILLS
Bartlett & Snow Co., C. O. (427–428)
Chemicolloid Labs., Inc. (257)
Eppenbach, Inc. (289)
W. J. Fitzpatrick Co., The (401–402)
Premier Mill Corp. (312–314)
Technicon Co., The (640B)
Union Process Co. (572A)
Will Corp. (667–668)

COLORIMETERS
American Instrument Co. (385–387)
Coleman Instrument Inc. (381–381A)
Eimer & Amend (57)
Fischer & Porter Co. (203–205–207)
Fischer Scientific Co. (57)
Gamma Scientific Co. (497)
National Technical Laboratories (265–269)
Palo Myers, Inc. (642)
Photovolt Corp. (270)
Rubicon Co. (380)
Scientific Glass Apparatus Co., Inc. (215, 217, 219)
Standard Scientific Supply Corp. (618)
W. M. Welch Scientific Co. (405)
Will Corp. (667–668)

COLORS, DRY
National Lead Co. (247)
Will Corp. (667–668)

COMPARATORS
Eimer & Amend (57) Fischer Scientific Co. (57)
Gamma Scientific Co. (497)
Grove Regulator Co. (640D)
Macbeth Corp. (201)
% Proportioneers, Inc. % (477–478)
Palo Myers, Inc. (642)
Scientific Glass Apparatus Co., Inc. (215, 217, 219)
Will Corp. (667–668)

COMPRESSORS
Allis-Chalmers Mfg. Co. (48–49)
Fuller Co. (315–317)
Ingersoll-Rand Co. (615–617)
Nash Engineering Co. (16)
Will Corp. (667–668)
Worthington Pump & Machy. Corp. (319–321)

CONCENTRATORS
Artisan Metal Products, Inc. (540–542)
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Denver Equipment Co. (507)
Haveg Corp. (51)
Industrial Process Engineers (441)
Knapp Mills, Inc. & Andrews-Knapp Construction Co., Inc. (23)
Maurice A. Knight Co. (53)
Niagara Blower Co. (233–235)
Productive Equipment Corp. (549)
Separations Engineering Corp. (52)
Swenson Evaporator Co. (Div. of Whiting Corp) (43)
Will Corp. (667–668)

(*Continued on page* 331)

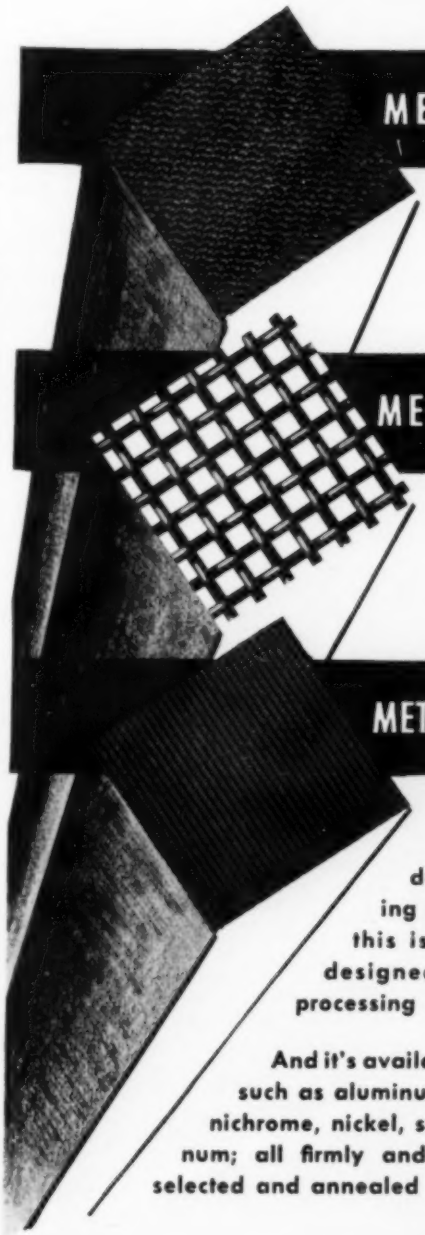
Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

Newark CONSIDERED BY MANY BEST for PROCESSING

Newark
METALLIC FILTER CLOTH

Newark
METALLIC BACKING CLOTH

Newark
METALLIC CENTRIFUGAL CLOTH



If you are looking for an accurate, durable metallic cloth for your filtering requirements come to Newark. For this is a "brand name" of wire cloth designed to stand-up under heavy duty processing service.

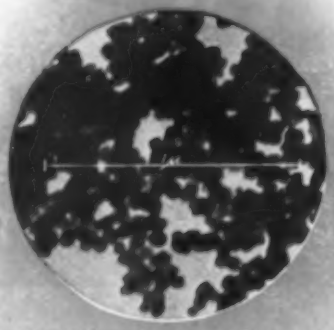
And it's available in the finest of meshes, in metals such as aluminum, brass, phosphor bronze, Monel, nichrome, nickel, stainless steel, gold, silver, or platinum; all firmly and uniformly woven from carefully selected and annealed wire.

Newark Wire Cloth COMPANY
350 VERONA AVENUE • NEWARK 4, N. J.

RCA ELECTRON MICROSCOPE . . .

discovers new products, new applications, new processes

[Its high resolving power and wide range of useful magnification now help industry look into the future]



PRECIPITATED $CaCO_3$ magnified 34,500 X. Note the small rhombs indicating the calcitic precipitated $CaCO_3$.

"THE RCA ELECTRON MICROSCOPE has become an indispensable tool in our research on pulp, paper, and related products," reports the West Virginia Pulp and Paper Co.

"Urgently needed facts about the shape and size of precipitated calcium-carbonate particles were uncovered with this instrument—made possible the development of an ultra-fine calcium carbonate for use as a rubber reinforcing agent.

"In another problem—the study of latex and 'Indulin'* co-precipitation—the electron microscope revealed that this process yields an excellent dispersion of 'Indulin' in the rubber, imparting strength and other desirable properties."

Hundreds of RCA electron microscopes are now being used throughout the world . . . helping great companies plan tomorrow's products . . . speeding research in many fields.

You have two models to choose from: the versatile "Universal" microscope or the budget-wise "Console" type (shown below). Both have high resolving power which enables useful photographic enlargement to 100,000 diameters. *Immediate* delivery can now be made on the "Console" . . . early delivery on the "Universal." Write to Dept. 23-K, for your booklet.

**A lignin now being made available commercially from Charleston, S. C.*

SCIENTIFIC INSTRUMENTS

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

EXHIBITORS
Classified by Products
CONTINUED

CONDENSERS
Allis-Chalmers Mfg. Co. (48–49)
Artisan Metal Products, Inc. (540–542)
S. Blickman, Inc. (474–475)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Fansteel Metallurgical Corp. (282–284)
General American Transportation Corp. (285–287)
Glascote Products, Inc. (657–658)
Goslin Birmingham Mfg. Co., Inc. (74)
Haveg Corp. (51)
Industrial Process Engineers (441)
Ingersoll-Rand Co. (615–617)
Knapp Mills, Inc. & Andrew-Knapp Construction Co., Inc. (23)
Maurice A. Knight Co. (53)
National Carbon Co., Inc. (30–31)
National Radiator Co. Industrial Div. (611–612)
Niagara Blower Co. (233–235)
Pfaudler Co., The (72–73)
Scientific Glass Apparatus Co., Inc. (215, 217, 219)
Schutte & Koerting Co. (291) jet & tubular
F. J. Stokes Machine Co. (80)
W. M. Welch Scientific Co. (405)
Welding Engineers, Inc. (407–408)
Will Corp. (667–668)
Worthington Pump & Machy. Corp. (319–321)

CONSERVATION STRUCTURES
General American Transportation Corp. (285–287)

CONTACTORS
Allis-Chalmers Mfg. Co. (48–49)
Owens-Corning Fiberglas Corp. (437–439) Packs

CONTAINERS
Carpenter Container Corp. (261)
Container Co. Div. Continental Can Co., Inc. (243–245)
Luzerne Rubber Co. (528–529)

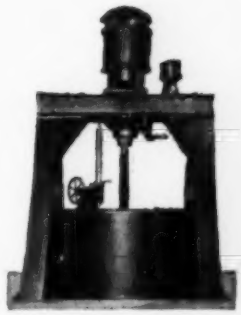
CONTROL APPARATUS
Allis-Chalmers Mfg. Co. (48–49)
American Instrument Co., The (385–387)
Bailey Meter Co. (274–276)
Builders-Providence, Inc. (479)
Electric Hotpact Co., Inc., The (655–656)
Fenwal, Inc. (640A)
Fischer & Porter Co. (203–205–207)
General Electric Co. (4)
Grove Regulator Co. (640D)
Industrial Instruments, Inc. (410)
Leslie Co. (676)
National Technical Laboratories (265–269)
Perkin-Elmer Corp., The (442)
Photoswitch, Inc. (603)
% Proportioneers, Inc. % (477–478)
Superior Electric Co. (522–523)
Will Corp. (667–668)

CONTROLLERS
American Instrument Co. (385–387) temperature
American Meter Co. (39–41)
Bailey Meter Co. (274–276) air-operated for flow, vacuum, etc.

(*Continued on page* 333)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

HIGH SPEED...
with
LABOR-SAVING
large bottom discharge for solids and
LARGEST CAPACITY
in proportion to basket diameter.



These features coupled with HIGH SPEED in acceleration, running, braking and unloading permit a greater proportion of productive running time . . . afford maximum daily output. Write for detailed information about these time- and money-saving.

FLETCHER CENTRIFUGALS
MOTOR-DRIVEN SUSPENDED AND OPEN-TOP
FLETCHER WORKS, 235 GLENWOOD AVE., PHILADELPHIA 40, PA.

VISIT OUR EXHIBIT BOOTHS 308-310 at 21st EXPOSITION of CHEMICAL INDUSTRIES

EQUIP IT TO "GROW GRACEFULLY" ON KEWAUNEE'S "UNIT ASSEMBLY PLAN"

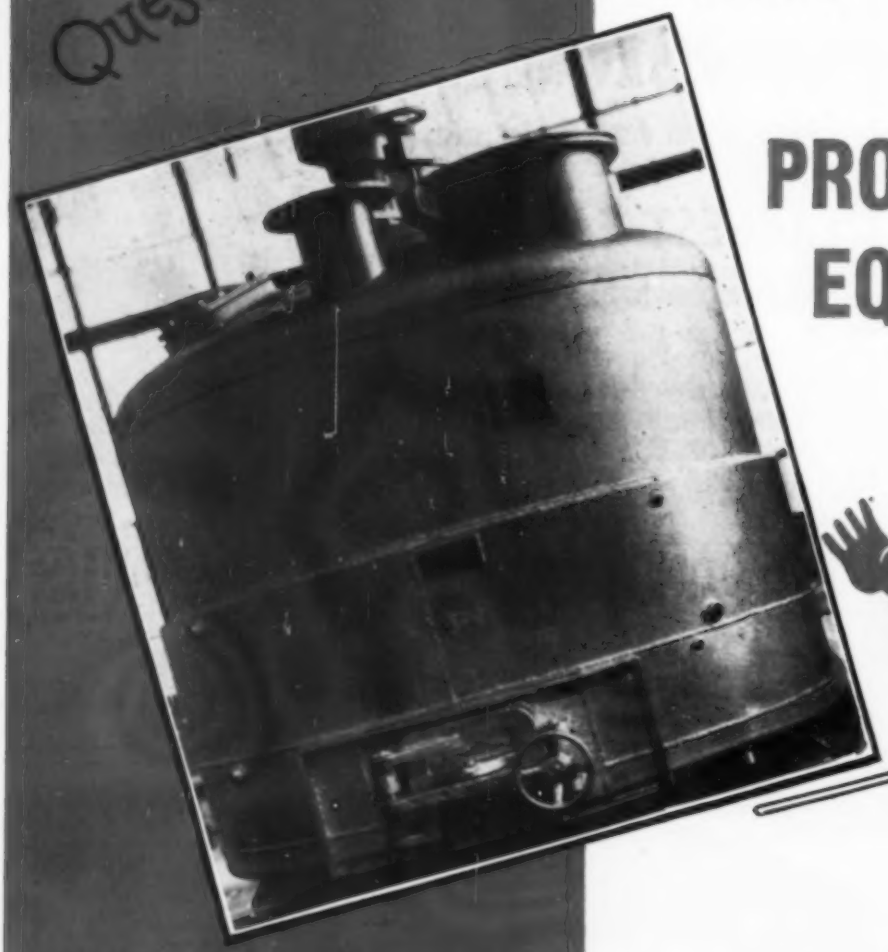
Experiment *in* YOUR LABORATORY NOT *with* IT!

You take the "experiment" out of laboratory planning when you install Kewaunee Laboratory Furniture, Cabinets and Casework. Simply select the Kewaunee units you need—all match exactly and are interchangeable, permitting your laboratory to "grow gracefully" as your facilities expand. Each piece made of finest materials . . . all table and working surfaces of Kewaunee's patented KemROCK for defiant resistance to acids, alkalies, abrasion and shock. Modernize efficiently—the Kewaunee way. For details—

WRITE: INDUSTRIAL DIVISION
Kewaunee Mfg. Co.
C. G. Campbell, President
5018 S. Center St., Adrian, Michigan—Representatives in Principal Cities

BOOTH 293

Question.. Question.. Who has a Question?
on
PROCESSING EQUIPMENT?



The new BUFLOVAK Filter Dryer combines a number of successive processing operations without removing the material from the equipment.

BUFLOVAK builds a complete line of processing equipment for Chemicals, Pharmaceuticals and Food Products, including Evaporators, Atmospheric and Vacuum Dryers, Solvent Recovery and Distillation equipment, Crystallizers, Chemical Plant Equipment and Castings.

BUFLOVAK cordially invites you to visit the booth and to discuss your processing problems.

Buflovak Invites You To Its Question-Answer Booth No. 6 at 21st Exposition of Chemical Industries

Grand Central Palace - N. Y.
December 1 to 6-1947

BUFLOVAK EQUIPMENT
Division of Blaw-Knox Company
1551 FILLMORE AVENUE
BUFFALO 11, N. Y.

EXHIBITORS
Classified by Products
CONTINUED

Builders-Providence, Inc. (479) flow
Burling Instrument Co. (403) temperature
Fischer & Porter Co. (203, 305, 207) flow rate
Grove Regulator Co. (640D) pressure
Industrial Instruments, Inc. (410) conductivity
Kieley & Mueller, Inc. (643) automatic for pressure, flow & liquid level
National Technical Laboratories (pH) (265–269)
Photoswitch, Inc. (603) liquid level
Milton Roy Co. (432–433) pH
Sarco Co., Inc. (11) temperature
Selas Corp. of America (533–534) combustion
Uehling Instrument Co. (356) liquid level, high & low alarm
Will Corp. (667–668) laboratory

CONVEYING MACHINERY & EQUIPMENT

Bartlett & Snow Co., C. O. (427–428)
Builders-Providence, Inc. (479)
Cargocaire Engrg. Corp. (621)
Denver Equipment Co. (507)
Eriez Mfg. Co. (631)
Harry J. Ferguson Co. (601–602)
Fuller Co. (315–317)
General Alloys Co. (299) high temperature
Great Western Mfg. Co. (372–374)
B. F. Gump Co. (362–364)
Horix Mfg. Co. (413–414)
Jeffrey Mfg. Co. (44A–45)
M. R. M. Co., Inc. (638)
Omega Machine Co. (480)
George G. Rodgers Co., Inc. (679)
Sprout, Waldron & Co. (550–553)
Syntron Co. (311–313)
U. S. Steel Corp. (76–77)

COOLERS

American Instrument Co., The (385–387)
Bartlett & Snow Co., C. O. (427–428)
Fuller Co. (315–317)
General American Transportation Corp. (285–287)
General Ceramics & Steatite Corp. (2)
Industrial Process Engineers (441)
Jeffrey Mfg. Co. (44A–45)
Maurice A. Knight Co. (53)
Louisville Drying Machinery Co. (285–287)
National Carbon Co., Inc. (30–31)
National Radiator Co.—Industrial Div. (611–612)
Niagara Blower Co. (233–235)
U. S. Stoneware Co., The (89–91)

COOPERAGE

Associated Cooperage Industries of America, Inc. (242)
Pressed Steel Tank Co. (348–352)

COUPLINGS

Great Western Mfg. Co. (372–374)
Koppers Co., Inc. (264)
Parker Appliance Co. (21)
Philadelphia Gear Works, Inc. (78) shaft
Sprout, Waldron & Co. (550–553)
Walworth Co. (316–318) pipe

(*Continued on page* 334)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

PRECIOUS METALS

AW

...for the Chemical and Metallurgical Industries

Stills, Retorts, Electrodes and other Special Process Equipment to order.

Laboratory Wares of all description.

Sheet, Wire, Tubing, Gauze and Fine Foils.

Salts and Solutions.

Platinum Metal Catalysts—Concentrated forms and on carriers.

Palladium, Iridium, Osmium, Rhodium and Ruthenium.

We pay highest prices for scrap platinum and have facilities for prompt recovery of spent platinum and palladium catalysts.

Sheet, Foil and Ribbon, pure and in alloy. Seamless Tubing. Laboratory Apparatus and Process Equipment.

Karat Golds. Fine Gold Anodes.

Fine, Sterling and Coin. Sheet, Wire, Circles and Foil.

Fine Silver Anodes. Rolled, Cast or in Shot Forms.

Silver Brazing Alloys and Fluxes for every industrial requirement.

WE INVITE YOUR INQUIRIES AND WILL SEND ON REQUEST FOLDERS:
C-20, *"Platinum, Gold and Silver for Science, Industry and the Arts"*
C-21, *"Platinum and Palladium Catalysts"*.

THE AMERICAN PLATINUM WORKS

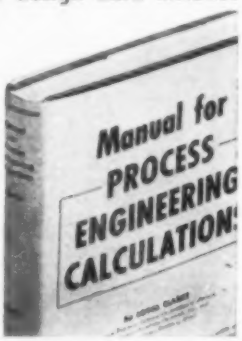
PRECIOUS METALS SINCE 1875

231 NEW JERSEY R.R. AVE., NEWARK 5, N. J.

Now

for greater speed and simplicity in chemical process calculations

—This wealth of design data includes over 300 helpful tables, charts, diagrams and equations . . .



This indispensable manual supplies engineers and chemists with a vast supply of concise, practical data to aid in engineering the development of chemical processes — from the research report stage to the final design stage. The material in this helpful book covers conversion factors, physical and mechanical properties, equipment performance factors, and briefs of the theory involved in unit operations common to many processes. Featured are hundreds of tables, charts and equations which are of the most aid in process engineering. Each is self-explanatory, and includes a complete listing of symbols, their significance, and units.

Just Published!

Manual for Process Engineering Calculations

By LOYAL CLARKE

Chemical Engineer, Celanese Corporation of America; Formerly with Petroleum Chemicals, Inc., and The United States Bureau of Mines

438 pages, 6 x 9, 145 figures, 160 tables, $6.00

Emphasis is placed in this invaluable process engineering manual on condensed methods of presentation. Working relations are highlighted throughout. The aim has been to supply the process engineer with just the information he needs, and to enable him to get at it as quickly and easily as possible.

Read over the chapter headings:

A. Perspective
B. Numerical and Mathematical Data
C. Conversion Tables
D. Physical and Mechanical Properties
E. Thermodynamic Data
F. Piping, Hydraulics, and Flow Measurements
G. Heat Transfer
H. Combustion
I. Power
J. Pumps
K. Fans, Blowers, and Compressors
L. Absorption, Stripping, Distillation
M. Water

See it 10 Days FREE • Mail Coupon

McGraw-Hill Book Company,
330 W. 42nd Street, NYC 18

Send me Clarke's Manual for Process Engineering Calculations for 10 days' examination on approval. In 10 days I will send $6.00, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....
Address .....
City and State .....
Company .....
Position CE-11-47

(For Canadian price, write McGraw-Hill Company of Canada, Ltd., 12 Richmond Street E., Toronto 1.)

EXHIBITORS • Classified by Products • CONTINUED

CRUCIBLES
Amersil Co., Inc. (454)
Baker & Co., Inc. (451–452) platinum
Norton Co. (415–416) laboratory
Scientific Glass Apparatus Co., Inc. (215, 217, 219)
Selas Corp. of America (533–534) filter
Titanium Alloy Mfg. Co. (366–368) zircon
W. M. Welch Scientific Co. (405)
Will Corp. (667–668)

CRUSHERS, GRINDING MILLS & PULVERIZERS
Allis-Chalmers Mfg. Co. (48–49)
Bartlett & Snow Co., C. O. (427–428)
Bramley Machinery Corp. (524–525)
Combustion Eng. Co., Inc.—Raymond Pulverizer Div. (67)
Denver Equipment Co. (507)
Eimco Corp., The (605–606)
Eimer & Amend (57)
Fischer Scientific Co. (57)
W. J. Fitzpatrick Co., The (401–402)
Great Western Mfg. Co. (372–374)
B. J. Gump Co. (362–364)
Hardinge Co., Inc. (60)
Jay Bee Sales Co. (370)
Jeffrey Mfg. Co. (44A–45)
Pulverizing Machinery Co. (300–302)
Sprout, Waldron & Co. (550–553)
Sturtevant Mill Co. (3)
U. S. Stoneware Co., The (89–91)
Union Process Co. (572A)
Will Corp. (667–668)
Williams Pat. Crusher & Pulverizing Co. (295)

CRYSTALLIZING EQUIPMENT
Artisan Metal Products, Inc. (540–542)
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Dorr Co., The (64–65)
Goslin Birmingham Mfg. Co., Inc. (74)
General American Transportation Corp. (285–287)
Haveg Corp. (51)
Industrial Process Engineers (441)
L. O. Koven & Bro., Inc. (304–306)
Pfaudler Co., The (72–73)
Stokes Machine Co., F. J. (80)
Swenson Evaporator Co. (Div. of Whiting Corp.) (43)

CYLINDERS FOR HIGH PRESSURE GASES
Hoke, Inc. (213)
Pressed Steel Tank Co. (348–352)
U. S. Steel Corp. (76–77)

CO_2 RECORDERS
Baird Associates, Inc. (610)
Cambridge Instrument Co., Inc. (330–332)
Permutit Co., The (400)
Uehling Instrument Co. (356)
Will Corp. (667–668)

DECOLORIZATION & PURIFYING MATERIALS
Davison Chemical Corp., The (622–624)
Johns-Manville Corp. (93–94)
Will Corp. (667–668)

DEHUMIDIFIERS
Cargocaire Engrg. Corp. (621)

DETERGENTS
Alrose Chemical Co. (490)
American Resinous Chemicals Corp. (35–36)
Carbide & Carbon Chemicals Corp. (17–18)
General Aniline & Film Corp. (619–620)
Hercules Powder Co. (W part of 7)
Sharples Chemicals, Inc. (25–25A)
L. Sonneborn Sons, Inc. (471)
Standard Scientific Supply Corp. (618)

DIGESTERS
Allis-Chalmers Mfg. Co. (48–49)
Black, Sivalls & Bryson, Inc. (496)
Dorr Co., The (64–65)
General American Transportation Corp. (285–287)
Haveg Corp. (51)
Industrial Process Engineers (441)
Knapp Mills, Inc. & Andrews-Knapp Construction Co., Inc. (23)
L. O. Koven & Bro., Inc. (304–306)
Pfaudler Co., The (72–73)
Welding Engineers, Inc. (407–408)

DISSOLVERS
Carbide & Carbon Chemicals Corp. (17–18)
Cowles Co., Inc., The (572)
General Ceramics & Steatite Corp. (2)
Haveg Corp. (51)
Industrial Process Engineers (441)
L. O. Koven & Bro., Inc. (304–306)
New England Tank & Tower Co. (50)

DISTILLING MACHINERY & APPARATUS
Distillation Products, Inc. (625–626)
F. J. Stokes Machine Co. (89)

DRIVES
Allis-Chalmers Mfg. Co. (48–49)
Baldwin Belting, Inc. (662)
Cleveland Worm & Gear Co. (502–503)
General Electric Co. (4)
B. F. Gump Co. (362–364)
Industrial Process Engineers (441)
Mixing Equipment Co., Inc. (307–309, 334–336)
New England Tank & Tower Co. (50)
Philadelphia Gear Works, Inc. (78) gear
Reliance Electric & Engineering Co. (674–675) The

DRYERS—CENTRIFUGALS
American Tool & Machine Co. (412)
Baker Perkins, Inc. (62–63)
Bird Machine Co. (535–536, 543–544)
Fletcher Works, Inc. (33)
Sharples Co., The (58–59)
Swenson Evaporator Co.—Div. of Whiting Corp. (43) spray
Tolhurst Centrifugals Div. American Machine & Metals, Inc. (68–69)

DRYING MACHINERY & EQUIPMENT
Allis-Chalmers Mfg. Co. (48–49)
Artisan Metal Products, Inc. (540–542)
Bartlett & Snow Co., C. O. (427–428)
Bowen Engineering, Inc. (493–495)
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Cargocaire Engrg. Corp. (621)
Combustion Eng. Co., Inc.—Raymond Pulverizer Div. (67)

(*Continued on page* 336)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

NEW PUMP GIVES

Unusual Range

OF CAPACITIES, HEADS

THE NEW "Pedrifugal"* Pedestal Type CENTRIFUGAL PUMP

Specially Designed for Flexible V-Belt Drives

BY CHANGING ONE sheave, you can quickly change speed and capacity of this pump — adapt it to your exact needs. Further variations are possible through interchangeable impellers and casings.

That's why only three basic sizes of "Pedrifugal" pumps meet every average pumping requirement from 10 to 500 gpm, and heads up to 100 ft!

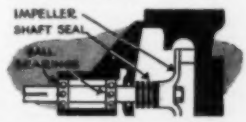
Now you can buy a pump for any normal job, right off the shelf! The "Pedrifugal" pump is versatile, compact, dependable — engineered, built and backed by Allis-Chalmers — offered at the lowest possible price consistent with high standards of design, material and workmanship.

See the new "Pedrifugal" pump at your nearest A-C office or dealer. Or, write for bulletin 52 B6691. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 2307

BUY IT "OFF THE SHELF" Pump can be bought "bare" or as a complete unit: pump, motor, Texrope drive and welded steel base. Also can be coupled or belted to a motor, a gasoline engine or power take-off which you already have.

LONG SERVICE WITH MINIMUM MAINTENANCE—All moving parts quickly accessible without disconnecting pipes. No packing rings to replace . . . bearings have 3 to 5 year supply of grease under normal operating conditions.

INTERCHANGEABLE CASING AND IMPELLER—1" by 1", 2" by 2" and 3" by 3" sizes differ only in impeller and casing. Pedestal casting, shaft, ball bearings, mechanical seal and impeller nut are the same in all sizes.



QUALITY CONSTRUCTION—Two large ball bearings, grease sealed ... High grade mechanical shaft seal ... Heavy 1 in. machined shaft, with keyways and impeller lock nut ... Bronze open type impeller ... Heavy, generous design throughout.

*Allis-Chalmers Trademark

ALLIS·CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

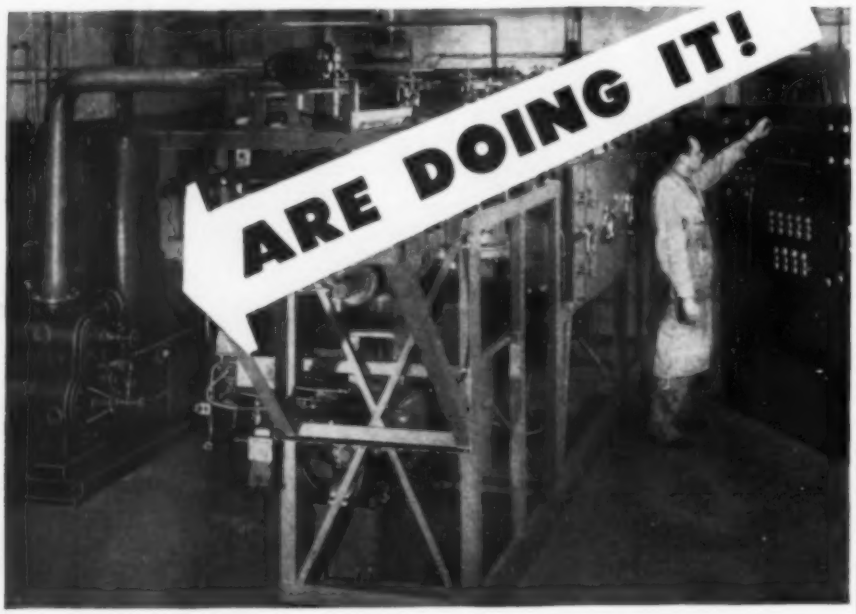
1847 1947 A CENTURY OF SERVICE to Industry THAT MADE America Great

IT'S DONE WITH

Mirrors ...

KINNEY

VACUUM PUMPS



Coating of front surface mirrors—another wonder product of low pressure processing—is done automatically in this National Research Corporation installation using a KINNEY Vacuum Pump. The KINNEY Single Stage Vacuum Pumps, used in conjunction with diffusion pumps, maintain the low absolute pressures essential for this high vacuum evaporation process. In all parts of the world the uses of KINNEY Pumps are countless—from dehydrating foods to producing penicillin; from exhausting lamps and tubes to sintering alloy metals. Wherever low absolute pressures must be created *and maintained*, KINNEY Pumps are giving reliable service. KINNEY Single Stage Pumps, available in 8 sizes with displacements of 13 to 702 cu. ft. per min., maintain low absolute pressures to 10 microns; Compound Pumps in 2 sizes, 15 and 46 cu. ft. per min., maintain low pressures to 0.5 micron.

KINNEY
Single Stage
Vacuum Pump

Ask for Catalog V45

KINNEY MANUFACTURING COMPANY

3545 WASHINGTON ST., BOSTON 30, MASS.

NEW YORK • CHICAGO • PHILADELPHIA • LOS ANGELES • SAN FRANCISCO

FOREIGN REPRESENTATIVES

General Engineering Co. (Radcliffe) Ltd., Station Works, Bury Road, Radcliffe, Lancashire, England
Horrocks, Roxburgh Pty., Ltd., Melbourne, C. I. Australia
W. S. Thomas & Taylor Pty., Ltd., Johannesburg, Union of South Africa

WE ALSO MANUFACTURE LIQUID PUMPS, CLUTCHES AND BITUMINOUS DISTRIBUTORS

EXHIBITORS
Classified by Products
CONTINUED

Denver Equipment Co. (507)
Eimco Corp., The (605–606)
Electric Hotpack Co., Inc., The (655-656)
Filtration Engineers, Inc. (8)
General American Transportation Corp. (285–287)
Glengarry Machine Works, Inc. (659-660)
W. A. Hammond Drierite Co. (286)
Hardinge Co., Inc. (60)
Hersey Mfg. Co. (499)
Industrial Process Engineers (441)
Jeffrey Mfg. Co. (44A–45)
Louisville Drying Machinery Co. (285–287) direct heat, rotary, drum
Lukens Steel Co.—By-Products Steel Corp. (558–563)
National Research Corp. (472–473)
Pfaudler Co., The (72–73)
Proctor & Schwartz, Inc. (15)
F. J. Stokes Machine Co. (80)
Swenson Evaporator Co.—Div. of Whiting Corp. (43)
Syntron Co. (311–313)
Trent, Inc. (526–527)
Williams Pat. Crusher & Pulv. Co. (295)

DRUMS, ROTARY, VACUUM

Bartlett & Snow Co., C. O. (427–428)
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Eimco Corp., The (605–606)
Filtration Engineers, Inc. (8)
Heil Process Equipment Corp. (575) utility
Lukens Steel Co.—By-Products Steel Corp. (558–563)
Oliver United Filters, Inc. (65–66)
F. J. Stokes Machine Co. (80)

DUST & FUME COLLECTING SYSTEMS

Bartlett & Snow Co., C. O. (427–428)
Dust & Fume Control Division—American Wheelabrator & Equipment Co. (481–484)
Federal Classifier Systems, Inc. (404)
Haveg Corp. (51)
Maurice A. Knight Co. (53)
Pangborn Corp. (75)
Pulverizing Machinery Co. (300–302)
Claude B. Schneible Co. (421–422)
W. W. Sly Mfg. Co. (487–488)
Sprout, Waldron & Co. (550–553)
Will Corp. (667–668) lab. type

DUST & SPRAY MASKS

Mine Safety Appliances Co. (376–378)

EJECTORS

Andrews-Knapp Construction Co., Inc. (23)
Allis-Chalmers Mfg. Co. (48–49)
Duriron Co., Inc., The (19–20)
General Ceramics & Steatite Corp. (2)
Haveg Corp. (51)
Illinois Electric Porcelain Co. (672-673)
Ingersoll-Rand Co. (615–617)
Knapp Mills, Inc. (23)
Schutte & Koerting Co. (291)
Worthington Pump & Machy. Corp. (319–321)

(*Continued on page* 338)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

The accuracy and versatility of many pH instruments are limited by the electrode system – *BUT NOT BECKMAN EQUIPMENT!*

...THE INDUSTRY'S MOST COMPLETE LINE OF MODERN pH ELECTRODES IS AVAILABLE FOR USE WITH BECKMAN pH INSTRUMENTS

REMEMBER THIS important fact about modern pH equipment—glass electrode pH instruments are the most advanced and efficient type of pH equipment obtainable. *But no glass electrode instrument is better than the versatility, accuracy and dependability of the electrode assemblies available for use with it.*

And that is another of the many vital advantages that are yours when you select BECKMAN pH Instruments—for Beckman, *pioneer of modern glass electrode pH equipment*, not only provides the finest and most advanced pH instruments, but also the industry's most complete line of electrodes for use with these instruments.

Illustrated below are only a few of the more than 90 different types of interchangeable Beckman pH Electrodes that assure maximum accuracy, convenience and wide-range adaptability to users of Beckman pH Meters—the pH instruments that are the recognized standard of the industry.

No matter what your pH problem, there is a Beckman pH Instrument and a Beckman Glass Electrode assembly to meet your exact requirements for both industrial and research applications. So why restrict your operations with anything less than the complete pH facilities provided by Beckman?

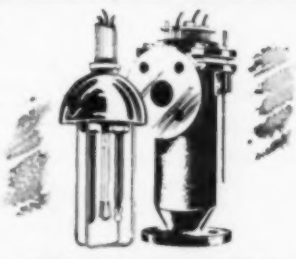
HIGH pH GLASS ELECTRODES. Pioneered by Beckman, these glass electrodes permit accurate measurement of high pH solutions with negligible error *even in the presence of sodium ions.* Ideal for use on detergents, soaps and many other applications where regular glass electrodes are useless.

HIGH TEMPERATURE GLASS ELECTRODES. Another development pioneered by Beckman, these electrodes can be used directly in high temperature process solutions to 100° C. (212° F.) without damage. Eliminates special sampling devices and greatly simplifies control of hot processing solutions.

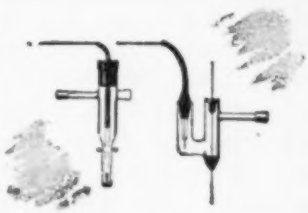
RUGGED DUTY GLASS ELECTRODES. Still another Beckman development, these electrodes are specially designed for direct immersion in tanks and flow lines where abrasion is severe (paper pulps, ore slurries, etc.). Not only abrasion resistant, but also withstand more than 100 lbs. pressure on immersion end.

PENETRATION TYPE GLASS ELECTRODES. The pointed application end greatly simplifies direct pH measurements of cheeses, fish, fruits and similar semi-solids where penetration of outer surface is desired for internal pH measurements.

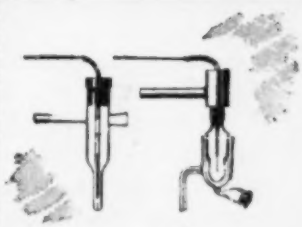
SURFACE TYPE GLASS ELECTRODES. On these Beckman electrodes the application end is nearly flat in order to simplify pH measurements on skin, hides and moist surfaces of materials where pH measurements of outer surfaces are desired.



IMMERSION AND FLOW TYPE ASSEMBLIES. Can be placed directly in flow lines, vats, tanks, etc., to permit direct and continuous pH measurements on process solutions. Far simpler, quicker and more accurate than sampling devices. Can be used with various types of Beckman electrodes.



MICRO GLASS ELECTRODES. One of dozens of specialized Beckman pH electrodes for science and laboratory investigations. This type permits quick, convenient and accurate pH measurements on samples of less than one drop.



HYPODERMIC GLASS ELECTRODES. One of many specialized Beckman pH electrodes for medical use. In this type, 0.5 ml blood samples can be injected from hypodermic needle through membrane with minimum exposure to air. Other types are also available.

THE ABOVE ARE ONLY TYPICAL of the wide selection of glass electrodes available for use with Beckman pH Instruments . . . one more reason why Beckman pH Instruments are recognized throughout the world for their dependability, accuracy and versatility. *Beckman Instruments, National Technical Laboratories, South Pasadena 14, Calif.*

BECKMAN

INSTRUMENTS CONTROL MODERN INDUSTRIES

When You Need *Corrosion-Proof Equipment*—

—You want equipment that is corrosion-proof not just on the surface but all the way through — that's KNIGHTWARE! These corrosion-proof ceramics result from selected raw materials, careful forming by master craftsmen and controlled processing backed by 40 years' experience. All KNIGHTWARE is of seamless, one-piece construction and will handle gases, all alkalies, and all acids except hydrofluoric acid and strong caustics.

These photos of our kilns give some idea of the many shapes of KNIGHTWARE produced. Pictured above, for instance, are 500 gallon jars, large kettles, roof ventilating caps, reducer pipe fittings, disc coolers and condensers. In the lower photo: lab. equipment including tanks, sinks, pipe and fittings. Other KNIGHTWARE products include towers, filters, rolls, sumps, coils and valves in both special and standard design.

Whatever your needs in chemical stoneware we can probably supply you. Write today for KNIGHTWARE literature. Please indicate type of equipment in which you are interested as well as service conditions involved.

At the CHEMICAL EXPOSITION *visit us at Exhibit No. 53*

KNIGHTWARE CHEMICAL EQUIPMENT

MAURICE A. KNIGHT
1011 Kelly Ave., Akron 6, Ohio

EXHIBITORS
Classified by Products
CONTINUED

ELECTRONIC EQUIPMENT
Allis-Chalmers Mfg. Co. (48–49)
Bailey Meter Co. (274–276)
Baird Associates, Inc. (610)
Eimer & Amend (57)
Fischer Scientific Co. (57)
General Electric Co. (4)
Hardinge Co., Inc. (60)
Hart-Moisture-Meters (573A)
Industrial Instruments, Inc. (410)
Jeffrey Mfg. Co. (44A–45)
Macbeth Corp. (201)
National Technical Laboratories (265 to 269)
North American Phillips Co., Inc. (539)
Perkin-Elmer Corp., The (442)
Photoswitch, Inc. (603)
Photovolt Corp. (270)
Process & Instruments (518)
Reliance Electric & Engr. Co., The (674–675)
Roy Co., Milton (432–433)
Syntron Co. (311–313)
Superior Electric Co. (522–523)
Tech Laboratories, Inc. (400A)
Weston Electrical Instrument Corp. (263)
Will Corp. (667–668)

ELEVATORS
Allis-Chalmers Mfg. Co. (48–49) step type
Barrett-Cravens Co. (239)
Bartlett & Snow Co., C. O. (427–428) bucket
Denver Equipment Co. (507)
Great Western Mfg. Co. (372–374)
B. F. Gump Co. (362–364)
Jeffrey Mfg. Co. (44A–45)
Sprout, Waldron & Co. (550 to 553) bucket
Syntron Co. (311–313)

EMULSIFIERS
Alrose Chemical Co. (490)
American Resinous Chemicals Corp. (35–36)
Atlas Powder Co. (46–47)
Carbide & Carbon Chemicals Corp. (17–18)
Chemicolloid Laboratories, Inc. (257)
Commercial Solvents Corp. (55)
Cornell Machine Co., The (633)
Cowles Co., Inc., The (572)
Denver Equipment Co. (507)
Darco Corp. (46–47)
General Aniline & Film Corp. (619–620)
Glyco Products Co., Inc. (225–227)
Mixing Equipment Co., Inc. (307–309, 334–336)
Pfaudler Co., The (72–73)
Premier Mill Corp. (312–314)
Sharples Chemicals, Inc. (25–25A)
Sonneborn Sons, Inc., L. (471)
Will Corp. (667–668)

EMULSIONS
Alrose Chemical Co. (490)
American Resinous Chemicals Corp. (35–36)
Glyco Products Co., Inc. (225–227)
Magnus, Mabee & Reynard, Inc. (498)
Neville Co. (547–548)
Sonneborn Sons, Inc., L. (471)
Socony-Vacuum Oil Co., Inc. (324–326)

(*Continued on page* 340)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

PROCTOR RESEARCH

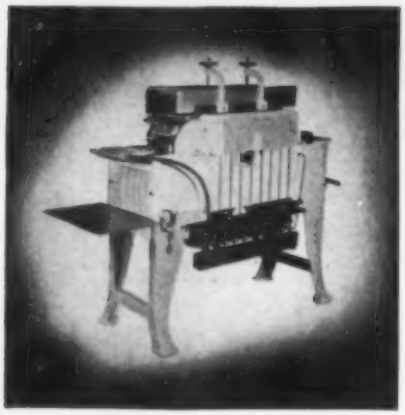
Each of the 11 products listed above represents a distinct and different drying problem. Magnesium carbonate, for example, must be dried from an initial moisture content of 565% (bone dry weight basis) to a moisture content of 0.1% at the rate of 500 pounds per hour (commercial dry weight), while starch is dried from 78.5% initial moisture content to 13.6% at the rate of 4,800 pounds per hour. Each of these products (and the list could be expanded many times) was studied by Proctor engineers, and the performance of the Proctor equipment finally installed was guaranteed in writing in the sales contract. In some cases the basic designs of the equipment was similar—but in each case modifications were made to suit the individual product or plant requirements. While all of these products are being dried in huge continuous systems equipped with preforming feeds—many problems brought to Proctor engineers have called for small tray or truck dryers. You may be sure that any problem—large or small—that you bring to Proctor & Schwartz, Inc. will receive the full benefit of all of the ingenuity and means at our disposal that were applied to solving the problems covered by these case histories.

For more complete information on how Proctor equipment is being applied to the drying of chemical products—visit our Booth #15 at the Exposition of Chemical Industries in Grand Central Palace—December 1-6—where the solutions to some of these problems will be featured.

Write for your copy of this New Proctor Booklet

If you have not already received this latest booklet—which gives complete information on these 11 chemical drying problems—write for your copy today. Ask for Bulletin #309.

PROCTOR & SCHWARTZ, INC. • PHILADELPHIA 20, PA.



The PerfeKtum AMPWASH

A unique machine which provides a new and improved method for washing and cleansing ampuls, vials, tubes, etc.

Semi-automatic in operation, the AMPWASH feeds, cleanses and discharges the ampuls rapidly and with a minimum of breakage. The AMPWASH is sturdily built of corrosion-resistant materials and is very flexible in operation. With a few simple adjustments, the machine may be adapted to feed and cleanse glass containers of a wide variety of sizes and shapes.

Write for literature on the AMPWASH and our other ampul filling and sealing apparatus.

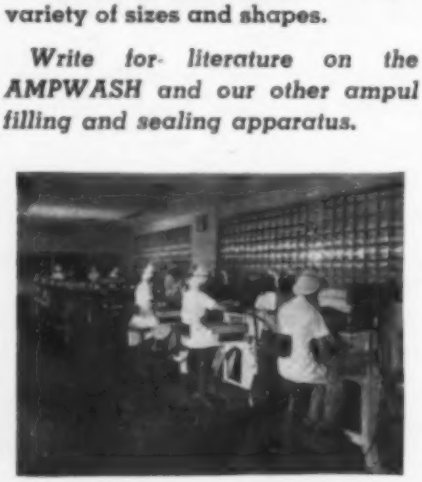


Illustration above shows the Ampul Washing Department in the Winthrop Chemical Company's new Ampul Bldg. Photograph courtesy of The Austin Co.

PerfeKtum TRADE MARK REG.

PerfeKtum PRODUCTS COMPANY

Serving Industry for 25 Years

300 Fourth Avenue New York 10, N. Y.

EXHIBITORS • Classified by Products • CONTINUED

ENAMELED APPARATUS
Glascote Products, Inc. (657–658) tanks, reacters

ENAMELS
Atlas Powder Co. (46–47)
Darco Corp. (46–47)
U. S. Stoneware Co., The (89 to 91)

ENGINEERS
Andrew-K..app Construction Co., Inc. (23)
Artisan Metal Products, Inc. (540–542)
Blaw-Knox Div. of Blaw-Knox Co. (13–14)
Denver Equipment Co. (507)
Dorr Co., The (64–65)
Falstrom Co. (510–511) steel fabricating
Filtration Engineers, Inc. (8)
General Ceramics & Steatite Corp. (2)
Illinois Water Treatment Co. (635)
Industrial Process Engineers (441)
Knapp Mills, Inc. (23)
Lukens Steel Co.—By-Products Steel Corp. Div. (558 to 563)
National Engr. Co. (554–555)
Process & Instruments (518)
% Proportioneers, Inc. % (477–478)
Republic Filters, Inc. (556–557)
Selas Corp. of America (533–534) combustion
Snell, Inc., Foster D. (37) consulting
Sprout, Waldren & Co. (550 to 553)
Stokes Machine Co., F. J. (80)
Welding Engineers, Inc. (407–408)

EVAPORATORS
Andrews-Knapp Construction Co., Inc. (23)
Artisan Metal Products, Inc. (540–542)
Blaw-Knox Div. of Blaw-Knox Co. (13–14)
Blickman, Inc., S. (474–475)
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Conkey Filter Co. (285–287) vertical, submerged, horizontal
Fansteel Metallurgical Corp. (282–284)
General American Transportation Corp. (285–287)
Goslin-Birmingham Mfg. Co., Inc. (74)
Kreiner Co., The Emil (226–228)
Haveg Corp. (51)
Industrial Process Engineers (441)
Knapp Mills, Inc. (23)
Koven & Bro., Inc., L. O. (304–306)
Pfaudler Co., The (72–73)
Scientific Glass Apparatus Co., Inc. (215 to 219)
Stokes Machine Co., F. J. (80)
Swenson Evaporator Co. Div. of Whiting Corp. (43)

EXHAUSTERS
Duriron Co., Inc., The (19–20)
General Ceramics & Steatite Corp. (2)
Haveg Corp. (51)
Ingersoll-Rand Co. (615–617)
Kewaunee Mfg. Co. (44A–45)
Schutte & Koerting Co. (291) jet
U. S. Stoneware Co., The (89 to 91)
Wright-Austin Co. (461A)

EXPLOSIVES
Atlas Powder Co. (46–47)
Darco Corp. (46–47)
Hercules Powder Co., Inc. (7-W)

EXTRACTION PLANTS
Allis-Chalmers Mfg. Co. (48–49) oil
Artisan Metal Products, Inc. (540–542)
Bartlett & Snow Co., C. O. (427–428)
Blaw-Knox Div. of Blaw-Knox Co. (13–14)
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Industrial Process Engineers (441)

EXTRACTORS
American Tool & Machine Co. (412)
Artisan Metal Products, Inc. (540–542)
Bird Machine Co. (535–536, 543–544)
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Carbide & Carbon Chemicals Corp. (17–18)
Carver, Inc., Fred S. (237)
Eriez Mfg. Co. (631) magnetic
Fletcher Works, Inc. (33)
Industrial Process Engineers (441)
Koven & Bro., Inc., L. O. (304–306)
Pfaudler Co., The (72–73)
Scientific Glass Apparatus Co., Inc. (215 to 219)
Stokes Machine Co., F. J. (80)
Welding Engineers, Inc. (407–408)
Will Corp. (667–668)

FEEDERS
Allis-Chalmers Mfg. Co. (48–49)
Bartlett & Snow Co., C. O. (427–428)
Black, Sivalls & Bryson, Inc. (466)
Builders-Providence, Inc. (479)
Denver Equipment Co. (507)
Federal Classifier Systems, Inc. (404) rotary
Fuller Co. (315–317)
Great Western Mfg. Co. (372–374)
Gump Co., B. F. (362–364)
Hardinge Co., Inc. (60)
Lapp Insulator Co., Inc. (500–501)
Omega Machine Co. (480)
Permutit Co., The (400)
% Proportioneers, Inc. % (477–478) chemical & proportioning
Roy Co., Milton (432–433)
Sprout, Waldron & Co. (550 to 553)
Syntron Co. (311–313)
Uehling Instrument Co. (356)
Wallace & Tiernan Products Co. (520–521)
Welding Engineers, Inc. (407–408)

FILLERS
Dicalite Co., The (86–87) mineral
Johns-Manville Corp. (93-94) mineral
Perl-Oussani Machine Mfg. Co. (604) bottles, cans, tubes, etc.
Stokes Machine Co., F. J. (80) tube

FILLING MACHINES
Glengarry Machine Works, Inc. (659–660) dry metals
Gump Co., B. F. (362–364)
Horix Mfg. Co. (413–414) liquid
Hormann & Co., Inc., F. R. (680) portable
Kiefer Machine Co., The Karl (24)
M. R. M. Co., Inc. (638)
PerfeKtum Products Co. (209–211)
Perl-Oussani Machine Mfg. Co. (604)
Pfaudler Co., The (72–73)
Pneumatic Scale Corp., Limited (22)
% Proportioneers, Inc. % (477–478)
Rodgers Co., Inc., George G. (679)
St. Regis Sales Corp. (531–532) bag

(*Continued on page* 341)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

EXHIBITORS Classified by Products CONTINUED

Scientific Glass Apparatus Co., Inc. (215 to 219)
Stokes Machine Co., F. J. (80)
Triangle Package Machinery Co. (514)
Will Corp. (667–668)

FILTER AIDS

Denver Equipment Co. (507)
Dicalite Co., The (86–87)
Hercules Filter Corp. (443–445)
Johns-Manville Corp. (93–94)
Republic Filters, Inc. (556–557)
U. S. Stoneware Co., The (89 to 91)
Will Corp. (667–668)

FILTER CLOTH

Denver Equipment Co. (507)
Eimer & Amend (57)
Filtration Engineers, Inc. (8)
Fischer Scientific Co. (57)
Jacoby-Tarbox Corp. (540 to 542)
Owens-Corning Fiberglas Corp. (437–439)
Republic Filters, Inc. (556–557)
Scientific Glass Apparatus Co., Inc. (215 to 219)
Shriver & Co., Inc., T. (12)
Will Corp. (667–668)

FILTER CLOTH—Metallic

Denver Equipment Co. (507)
Micro Metallic Corp. (671)
Newark Wire Cloth Co. (83–84)
Oliver United Filters, Inc. (66)
Republic Filters, Inc. (556–557)
Roebling's Sons, Inc., John A. (358–360)
Tyler Co., The W. S. (88)

FILTER PAPER

Alsop Engineering Corp. (293) pads, neutral asbestos
Angel & Co., Inc., H. Reeve (214)
Denver Equipment Co. (507)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Hercules Filter Corp. (443–445)
Hormann & Co., Inc., F. R. (680) special asbestos
Jacoby-Tarbox Corp. (540–542)
Palo Myers, Inc. (642)
Republic Filters, Inc. (556–557)
Scientific Glass Apparatus Co., Inc. (215 to 219)
Standard Scientific Supply Corp. (618)
Welch Scientific Co., W. M. (405)
Will Corp. (667–668)

FILTERS

Alsop Engineering Corp. (293) disc-pak
American Tool & Machine Co. (412) centrifugal
Bird Machine Co. (535–536, 543–544) continuous centrifugal, vacuum
Bramley Machinery Corp. (524–525) viscous liquids
Carver, Inc., Fred S. (237) hydraulic
Conkey Filter Co. (285–287) pressure, vacuum, feed
Denver Equipment Co. (507) disc, drum, laboratory
Elmco Corp., The (605–606) vacuum
Ertel Engineering Corp. (508–509)
Filtration Engineers, Inc. (8)
Fischer & Porter Co. (203 to 207) clarifying
General American Transportation Corp. (285–287)

(*Continued on page* 345)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

50 GASES

Matheson stocks more than fifty gases! No matter what you need in rare or common gases, if it is available, Matheson can supply it.

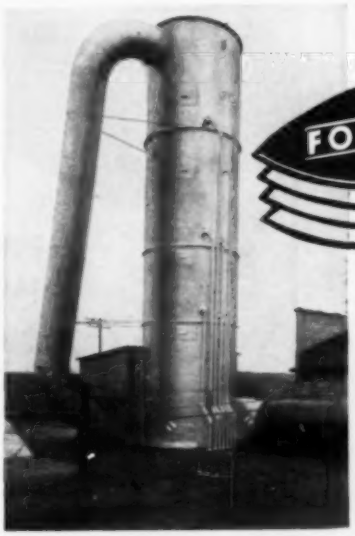
Matheson gases are packed in glass flasks, small cylinders for classroom demonstrations or research experiments and in larger cylinders for commercial use.

. . . . And Matheson has controls for all gases. Our years of experience coupled with our use of the finest materials assures you of controls that may be used for your most precise research work.

When visiting the Chemical Show in New York stop at Booth No. 271 for your copy of our Gas Data Bulletin.

THE MATHESON COMPANY

East Rutherford, N. J. Joliet, Ill.



FOUR PRONGED ATTACK

A SCHNEIBLE SYSTEM VERSUS UNUSUAL AIR CONTAMINANTS

In marches Schneible to whip this plant's problem of multiple air contaminants (hydrogen sulphide, ammonia and other traces) with a multiple-liquid, Multi-Wash Collector. Four separate solutions, piped into the Collector at different levels, meet the churning aprush of fouled plant air with a chemically active liquid curtain and spray that envelops and floods contaminants out for settling and disposal.

Your problem — be it fine dust, condensible vapors, or multiple contamination—will fall as readily before a Schneible engineered system. Schneible Collectors, adaptable to every condition, feature no moving parts and exhaust fan on the clean air side. Schneible ducts, hoods, pumps, tanks, etc., complete a system tailor-made to keep your plant air fresh, clean, and safe.

Write for bulletins . . . better yet, visit Booths 421-422 at the Chemical Industries Exposition.

CLAUDE B. SCHNEIBLE CO.
2827 Twenty-Fifth St., Detroit 16, Mich.
Representatives in Principal Cities

LIQUID-VAPOR INTIMATE CONTACT EQUIPMENT for DUST COLLECTION ABSORPTION CONDENSATION AND TEMPERATURE REDUCTION

SCHNEIBLE

BOOTH 421-422

NEW

LAPP

PULSAFEEDER

The Exclusive

PISTON-DIAPHRAGM

PROPORTIONING

PUMP

NO STUFFING BOX, no mechanical or liquid seal, absolutely no packing or other "leak-likely" gland can be in contact with liquid being handled.

CHEMICAL ISOLATED by diaphragm from working parts of pump.

NO CONTAMINATION. Product is protected from lubricants and from contact with atmosphere.

MICRO-ADJUSTABLE to any rate of flow by calibrated hand-wheel, while pump is in operation.

PERFECT LUBRICATION with all moving parts submerged in oil bath.

NEW CP MODEL HEAVY-DUTY PULSAFEEDER PUMP

AVAILABLE in simplex and duplex models of four sizes, ranging in capacity from less than 100 ml. per hour to 660 gallons per hour at pressures up to 2250 psig in certain models. Write for new bulletin, No. 262, which carries complete description and specifications.

Lapp

EXHIBITORS
Classified by Products
CONTINUED

General Ceramics & Steatite Corp. (2) suction
Goslin-Birmingham Mfg. Co., Inc. (74)
Haveg Corp. (51)
Hercules Filter Corp. (443 to 445)
Hormann & Co., Inc., F. R. (680) asbestos, industrial type
Illinois Water Treatment Co. (635)
Knight, Maurice A. (53) acid proof
Micro Metallic Corp. (671) porous, stainless steel
Niagara Filter Corp. (417–418) pressure, liquid, chemical, industrial
Norton Co. (415–416) laboratory
Oliver United Filters, Inc. (65–66) continuous vacuum & pressure
Owens-Corning Fiberglas Corp. (437–439)
Permutit Co., The (400) water
Productive Equipment Corp. (549) vibratory screen
% Proportioneers, Inc. % (477–478)
Republic Filters, Inc. (556–557) all types
St. Regis Sales Corp. (531–532) pressed plate
Selas Corp. of America (533–534) ceramic
Sharples Co., The (58–59) centrifugal
Shriver & Co., Inc. (12) pressure
Sparkler Mfg. Co. (516–517) horizontal plate, pressurized for liquids
Sperry & Co., D. R. (540 to 542) plate & frame
Standard Scientific Supply Corp. (618) stainless steel
Swenson Evaporator Co. Div. of Whiting Corp. (43) vacuum
Titeflex, Inc. (281) industrial, polishing. lab.
U. S. Stoneware Co., The (89 to 91) stoneware
Will Corp. (667–668) laboratory

FIRE DETECTION

Kidde & Co., Inc., Walter (423)
Mine Safety Appliances Co. (376–378)
Photoswitch, Inc. (603)

FIRE EXTINGUISHERS

Ansul Chemical Co. (82) dry chemical
Eimer & Amend (57)
Electro Chemical Supply & Engr. Co. (81) metallic fires
Fischer Scientific Co. (57)
Kidde & Co., Inc., Water (423)
Randolph Laboratories, Inc. (677)
Will Corp. (667–668)

FIRE PROOFING COMPOUNDS

Munn & Steele, Inc. (406)

FITTINGS

Andrews-Knapp Construction Co., Inc. (23) lead
Carpenter Steel Co. Alloy Tube Div. (491–492)
Grinnell Co., Inc. (251)
Haveg Corp. (51)
Hoke, Inc. (213)
Illinois Electric Porcelain Co. (672–673)
International Nickel Co. (9–10)
Jacoby-Tarbox Corp. (540 to 543) alloy
Knapp Mills, Inc. (53) lead
Ladish Co. (613–614)
Lead Lined Iron Pipe Co. (23)
National Carbon Co., Inc. (30–31)
National Lead Co. (247) lead

(*Continued on page* 346)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

for Effective protection against Chemical hazards . . . get WILLSON

Style No. X41

GLOVE-FIT PROTECTION AGAINST SPLASH . . . This Over-All® rubber goggle with snug fitting resilient rolled edge takes the danger out of splash and spatter; provides wearing comfort over spectacles.

Style No. 731

ONE-PIECE CAP CARTRIDGE . . . New chemical cartridge respirator with four interchangeable cap cartridge filters protects against low concentrations of specific vapors and gases. U. S. Bureau of Mines Approved.

Style No. 750D

SETTLE THE DUST PROBLEM . . . Newly approved by Bureau of Mines for all dusts. Easier breathing over long periods provided by extra large dual throw-away filters.

*Reg. U. S. Pat. Off.

For complete information on these products and their application, as well as many more eye and respiratory protective devices, get in touch with your nearest Willson distributor or write us direct.

"Booths 419-20 at the Chemical Show"

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON PRODUCTS, INCORPORATED

223 WASHINGTON STREET, READING, PA., U. S. A.

Need PURE Water?

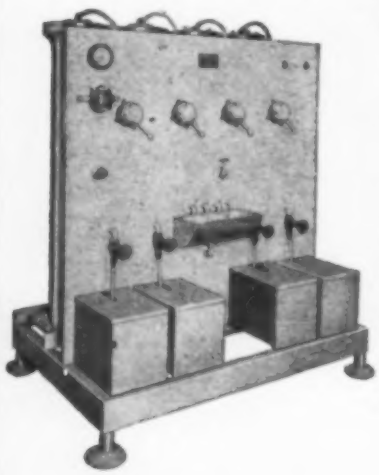
Specify Dependable

Barnstead Equipment

See Our Exhibit at the Chem Show—Booths 229 & 231

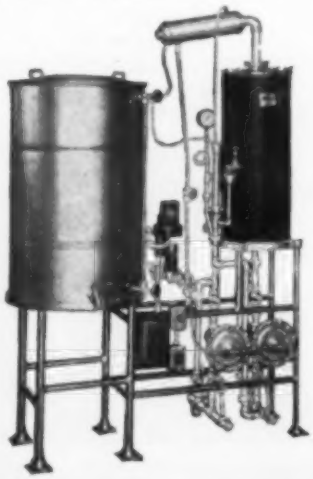
Specialists in Pure Water Since 1878

Almost 70 years ago Barnstead designed and built the first Automatic Water Still. From that Still to the outstanding new Barnstead "Double-Action" Demineralizer we have had one aim — to produce purer water at lower cost with greater ease. The many Barnstead improvements in design over these years have resulted in a far purer water at a fraction of the original cost. If your requirements for either distilled or demineralized water are from ½ to 1000 gallons per hour, you can satisfy them best with one of the 200 models and sizes in the complete Barnstead line.



BARNSTEAD DEMINERALIZERS

Barnstead Engineers have developed equipment which utilizes the de-ionizing principle to its fullest practical extent. Conventional 2-bed models as well as the new Barnstead "Double-Action" 4-bed models are available. Both types are available in bench models, portable floor models, and large floor models for permanent installation. In addition, there is the Barnstead Bantam for laboratory use which employs a renewable cartridge and requires no regeneration. Send for Bulletin 112A for complete information and prices.



BARNSTEAD AUTOMATIC WATER STILLS

Noted for their scientifically correct design, Barnstead Stills give trouble-free operation with a minimum of cleaning and attention. Many Barnstead stills sold over a generation ago are still in daily active service producing water far above the U. S. P. specifications. Special types for hard and soft water and for Pyrogen-free distillate for pharmaceutical houses. Models for heating by steam, electricity, gas, kerosene, or gasoline. Ask for new 1947 Catalog "F".

TRADE MARK REG U.S. PAT. OFF.

1870

Barnstead

STILL & STERILIZER CO. Inc.

4 Lanesville Terrace, Forest Hills, Boston 31, Mass.

EXHIBITORS
Classified by Products
CONTINUED

Parker Appliance Co., The (21) tube
Pfaudler Co., The (72–73) glass lined
Tri-Clover Machine Co. (567–568) sanitary, industrial
Tube Turns, Inc. (636–637) welding
Walworth Co. (316–318) pipe

FLOORING

Andrews-Knapp Construction Co., Inc. (23) lead
Electro Chemical Supply & Engr. Co. (81) acid proof
Johns-Manville Corp. (93–94)
Knight, Maurice A. (53)
Knapp Mills, Inc. (23) lead
Norton Co. (415–416) non-slip
United States Steel Corp. (76–77)
U. S. Stoneware Co., The (89 to 91)

FOOD INDUSTRIES EQUIPMENT

Allis-Chalmers Mfg. Co. (48–49)
Artisan Metal Products, Inc. (540 to 542)
Blickman, Inc., S. (474–475)
Blaw-Knox Div. of Blaw-Knox Co., (13–14)
Bramley Machinery Corp. (524–525)
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Carpenter Steel Co. Alloy Tube Div (491–492)
Carver, Inc., Fred S. (237)
Electro Chemical Supply & Engr. Co. (81)
Eppenbach, Inc. (289)
Eriez Mfg. Co. (631)
Falstrom Co. (510–511) control boards, steel cubicles
Fitzpatrick Co., The W. J. (401–402)
Glengarry Machine Works, Inc. (659–660)
Goslin-Birmingham Mfg. Co., Inc. (74)
Great Western Mfg. Co. (372–374)
Gump Co., B. F. (362–364)
Haveg Corp. (51)
Hills-McCanna Co. (346)
Horix Mfg. Co. (413–414)
Industrial Process Engineers (441)
Jeffrey Mfg. Co. (44A–45)
Kiefer Machine Co., The Karl (24)
LaBour Co., Inc., The (32)
Lapp Insulator Co., Inc. (500–501)
Luzerne Rubber Co. (528–529)
Lukens Steel Co.—By-Products Steel Corp. Div. (558 to 563)
M. R. M. Co., Inc. (638)
Micro Metallic Corp. (671)
Mixing Equipment Co., Inc. (307–309, 334–336)
Niagara Blower Co. (233–235)
Omega Machine Co. (480)
Pfaudler Co., The (72–73)
Photoswitch, Inc. (603)
Premier Mill Corp. (312–314)
Pressed Steel Tank Co. (348 to 352)
% Proportioneers, Inc. % (477–478)
Productive Equipment Corp. (549)
Republic Filters, Inc. (556–557)
Richmond Mfg. Co. (519)
Rodgers Co., Inc., George G. (679)
Schutte & Koerting Co. (291)
Sprout, Waldron & Co. (550 to 553)
Stokes Machine Co., F. J. (80)
Sturtevant Mill Co. (3)
Tyler Co., The W. S. (88)
U. S. Stoneware Co., The (89 to 91)
Wallace & Tiernan Products Co. (520–521)
Welding Engineers, Inc. (407–408)

(*Continued on page* 350)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

1,000 TO 5,000,000 GALLONS

Side Entering Mixers are for use on large tanks, for tanks where tops must be kept clear or where head room is limited.

This small gasoline blending tank is equipped with only a 5 HP mixer, blending all components in 1 to 2 hrs.

Send Now!

FOR INSTRUCTIVE LITERATURE

You should have these bulletins in your files. They contain valuable reference data available from no other source.

MIXING EQUIPMENT CO., INC.
1028 Garson Ave.
Rochester 9, N. Y.

TOP-ENTERING LIGHTNIN PORTABLE SIDE-ENTERING MIXCO

MIXING EQUIPMENT CO., INC.
1028 Garson Ave., Rochester 9, N. Y.

Please send me the literature checked:

- ☐ B-66 and B-76 Side Entering Mixers
- ☐ B-68 and 68B Permanently Mounted Mixers for Pressure Vessels and Open Tanks
- ☐ B-75—Portable Mixers (*Electric and Air Driven*)
- ☐ B-77—Laboratory Mixers
- ☐ Mi-11—Operating Data Sheet

Name_____

Title_____

Company_____

Address_____

Speed your
FLOOR-TO-FLOOR
MATERIALS HANDLING
WITH THIS
STREAMLINER
30° INCLINED
BELT CONVEYOR

This Streamliner operates either up or down at a constant speed of 45 feet per minute. "SET HIGH", it handles over-sized packages; "SET LOW" smaller packages can be handled within the protective guard rails. Unit is equipped with durable rough top rubber belt . . . is made in standard widths up to 30" . . . has manual take-up for belt slack . . . may be provided with free-rolling casters for portability . . . or can be supported from one floor.

Write for detailed information.

HARRY J. FERGUSON CO.
WHEEL • PORTABLE BELT • BELT AND ROLLER GRAVITY CONVEYORS
117 WEST AVE., JENKINTOWN, PENNA.

EXHIBITORS • Classified by Products • CONTINUED

FURNACES & ACCESSORIES
American Instrument Co., The (385–387) laboratory
Eclipse Fuel Engr. Co. (504) heat treating
Eimer & Amend (57)
Electric Hotpack Co., Inc., The (655–656) electric, high temp.
Fischer Scientific Co. (57)
General Alloys Co. (299) furnace parts
General Electric Co. (4)
National Research Corp. (472–473) high vacuum
Norton Co. (415–416) mufflers
Palo Myers, Inc. (642) electric, laboratory
Photoswitch, Inc. (603) oil and gas burner controls
Scientific Glass Apparatus Co., Inc. (215 to 219) laboratory
Selas Corp. of America (533–534) gas fired
Standard Scientific Supply Corp. (618) mufflers
Thomas Co., Arthur H. (665–666) micro
Trent, Inc. (526–527) electric
Will Corp. (667–668) laboratory

GAGES
Bailey Meter Co. (274–276) indicating, recording, controlling
Builders-Providence, Inc. (479) flow
Distillation Products, Inc. (625–626) high vacuum
Fischer & Porter Co. (203 to 207) flow rate
Greiner Co., The Emil (226–228)
Hoke, Inc. (213) pressure & flow
Jerguson Gage & Valve Co. (564) liquid level
Meriam Instrument Co., The (512–513) mercury pressure
National Research Corp. (472–473) vacuum
Ohio Chemical & Mfg. Co., The (216) H. P. gas
Process & Instruments (518) vacuum
Radio Corp. of America—Victor Div. (627–628) vacuum
Scientific Glass Apparatus Co., Inc. (215 to 219) vacuum
Scott Electroflux Co. (601B)
Stokes Machine Co., F. J. (80) vacuum
Uehling Instrument Co. (356)
Welch Scientific Co., W. M. (405) vacuum
Will Corp. (667–668) vacuum, pressure

GAS BOOSTERS
Allis-Chalmers Mfg. Co. (48–49)
American Instrument Co., The (385–387
Eclipse Fuel Engr. Co. (504)
Ingersoll-Rand Co. (615–617)
Schutte & Koerting Co. (291)

GAS PRODUCERS
Davison Chemical Corp., The (622–624)
Koppers Co., Inc. (264)
Koven & Bro., Inc., L. O. (304–306)

GAS PURIFIERS
Blaw-Knox Div. of Blaw-Knox Co. (13–14)
Haveg Corp. (51)
Knight, Maurice A. (53)
Koppers Co., Inc. (264)
Koven & Bro., Inc., L. O. (304–306)
Wright Austin Co. (461A)

GASES
Ansul Chemical Co. (82) liquidified, sulfur dioxide and methyl chloride
Carbide & Carbon Chemicals Corp. (17–18)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Ohio Chemical & Mfg. Co., The (216)
Scientific Glass Apparatus Co., Inc. (215 to 219)

GEARS
Bartlett & Snow Co., C. O. (427–428)
Great Western Mfg. Co. (372–374)
Philadelphia Gear Works, Inc. (78)

GLASS—Optical
American Instrument Co., The (385–387)
Fischer & Porter Co. (203 to 207)
Will Corp. (667–668)
Willson Products, Inc. (419–420)

GLASSWARE
Ace Glass, Incorporated (383)
Corning Glass Works (391–393)
Eimer & Amend (57)
Fischer & Porter Co. (203 to 207)
Fischer Scientific Co. (57)
Greiner Co., The Emil (226–228)
Kimble Glass Div. of Owens-Illinois Glass Co. (342–344) chemical, laboratory, Dairy Testware
Palo Myers, Inc. (642)
Scientific Glass Apparatus Co., Inc. (215 to 219)
Standard Scientific Supply Corp. (618) laboratory
Thomas Co., Arthur H. (665–666)
Welch Scientific Co., W. M. (405)
Will Corp. (667–668)

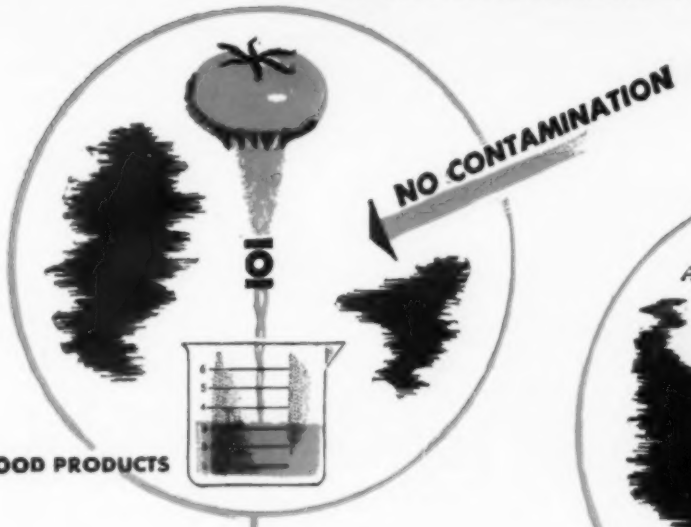
GRATING
Blaw-Knox Div. of Blaw-Knox Co. (13–14)
Welch Scientific Co., W. M. (405)

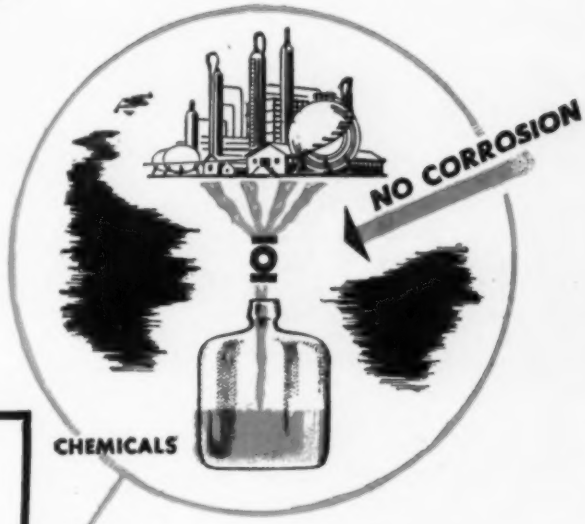
GRINDERS
Bramley Machinery Corp. (524–525)
Chemicolloid Laboratories, Inc. (257)
Combustion Engr. Co., Inc.—Raymond Pulverizer Div. (67)
Denver Equipment Co. (507)
Gump Co., B. F. (362–364)
Jay Bee Sales Co. (370)
Jeffrey Mfg. Co. (44A–45)
Pulverizing Machinery Co. (300–302)
Sprout, Waldron & Co. (550 to 553)
Sturtevant Mill Co. (3)
Syntron Co. (311–313)
U. S. Stoneware Co. (89–91)
Will Corp. (667–668)

HEAT EXCHANGERS
Allis-Chalmers Mfg. Corp. (48–49)
Andrews-Knapp Construction Co., Inc. (23) lead
Artisan Metal Products, Inc. (540–542)
Black, Sivalls & Bryson, Inc. (496)
Blaw-Knox Div. of Blaw-Knox Co. (13–14)
Blickman, Inc., S. (474–475)
Duriron Co., Inc., The (19–20)
Eastern Industries, Inc. (220 to 224)
Fansteel Metallurgical Corp. (282–284)
General Ceramics & Steatite Corp. (2)
Goslin Birmingham Mfg. Co., Inc. (74)
Haveg Corp. (51)
Heil Process Equipment Corp. (575)
Industrial Process Engineers (441)

(*Continued on page* 352)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.





A Valve with . . .

★ ISOLATED WORKING PARTS
★ CORROSION-PROOF LININGS
★ STREAMLINED FLOW

GRINNELL-SAUNDERS DIAPHRAGM VALVES

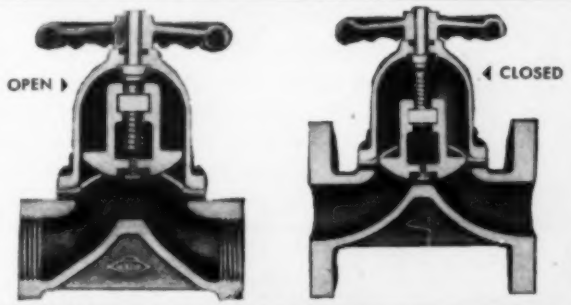
● The flexible diaphragm isolates the working parts of the valve from the fluid, preventing contamination, and permits streamlined flow plus positive closure even with suspended solids.

A selection of diaphragm materials and also body linings of glass, porcelain, lead, rubber or synthetics protects against corrosion.

- No packing glands to demand constant attention. Non-rising stem eliminates breakage . . . sealed for protection from dust, weather and corrosion.
- Working parts completely isolated from the fluid. No sticking, corroding or clogging to interfere with easy operation and tight closure. No contamination from valve lubricants.
- Compressor and finger plate combine to support the diaphragm in all positions.
- The large area of contact of the diaphragm on the seat, plus the resilience of the diaphragm, permits positive closure even when foreign matter is trapped.
- No metal-to-metal seats to become damaged or wire-drawn.
- No refacing or reseating is required.
- Streamlined passage without pockets reduces friction to a minimum and prevents accumulation of sludge and foreign solids.
- The valve body—the only metal that could contact the fluid—can be completely lined with glass, porcelain, lead, rubber or synthetic compounds (flange type only) to suit service requirements.

Write for catalog describing Grinnell-Saunders Diaphragm Valves—standard and special types.

GRINNELL COMPANY, INC.
Providence 1, R. I., U.S.A.
Branch Offices in Principal Cities



GRINNELL
FOUNDED 1850
WHENEVER PIPING IS INVOLVED

Regardless of the nature of the gas or liquid to be handled, you can choose a TITEFLEX all-metal flexible tubing of the required corrosion resistance. For TITEFLEX tubing is furnished with innercore made of brass, monel, inconel, nickel-clad, or stainless steel to assure satisfactory performance over a wide temperature range and under practically all conditions where corrosion is encountered. TITEFLEX also offers a wide choice of materials for braiding and fittings.

Remember, too, that TITEFLEX is constructed entirely of metal—with no packing to wear away or disintegrate. Play safe, specify TITEFLEX ALL-METAL flexible tubing for replacements and for new installations. Competent engineering service available on request.

See the TITEFLEX Exhibit of Tubing and Filters at Booth #281, Chemical Industries Exposition

Titeflex, Inc. Frelinghuysen Ave., Newark 5, N. J.

Exclusive Manufacturers of Titeflex high quality products for more than 30 years

Sales Offices { CHICAGO CLEVELAND DETROIT PHILADELPHIA LOS ANGELES BOSTON SAN FRANCISCO TORONTO

EXHIBITORS
Classified by Products
CONTINUED

Knapp Mills, Inc. (23) lead
Knight, Maurice A. (53)
National Carbon Co., Inc. (30–31)
National Radiator Co., The Industrial Div. (611–612)
Niagara Blower Co. (233–235)
Parker Appliance Co., The (21) coil
Patterson-Kelley Co., Inc., The (248)
Pfaudler Co., The (72–73)
Pressed Steel Tank Co. (348 to 352)
Schutte & Koerting Co. (291)
United States Steel Corp. (76–77)
Welding Engineers, Inc. (407–408)

HEATERS AND HEATING EQUIPMENT

American Instrument Co., The (385–387)
Amersil Co., Inc. (454)
Black, Sivalls & Bryson, Inc. (496)
Eclipse Fuel Engr. Co. (504)
Electric Hotpack Co., Inc., The (655–656)
Fansteel Metallurgical Corp. (282–284)
General Electric Co. (4)
Goslin-Birmingham Mfg. Co., Inc. (74)
Grinnel Co., Inc. (251)
Heil Process Equipment Corp. (575)
National Carbon Co., Inc. (30–31)
Photoswitch, Inc. (603)
Schutte & Koerting Co. (291)
Scientific Glass Apparatus Co., Inc. (215 to 219)
Standard Scientific Supply Corp. (618)
Trent, Inc. (526–527)
Wiegand Co., Edwin L. (634)
Will Corp. (667–668)

HEATING SYSTEMS AND ACCESSORIES

Eclipse Fuel Engr. Co. (504)
Grinnell Co., Inc. (251)
Photoswitch, Inc. (603)
Sarco Co., Inc. (11)

HOISTS

Allis-Chalmers Mfg. Co. (48–49)
Barrett-Cravens Co. (239)
Cargocaire Engrg. Corp. (621)
Denver Equipment Co. (507)
Ingersoll-Rand Co. (615–617)
Yale & Towne Mfg. Co., The (278)

HOMOGENIZERS

Andrews-Knapp Construction Co., Inc. (23)
Chemicolloid Laboratories, Inc. (257)
Cornell Machine Co., The (633)
Eimer & Amend (57)
Eppenbach, Inc. (289)
Fischer Scientific Co. (57)
Fitzpatrick Co., The W. J. (401–402)
Knapp Mills, Inc. (23)
Marco Co., Inc. (646–647)
Premier Mill Corp. (312–314)
Will Corp. (667–668)

HOODS—Fume

Alberene Stone Corp. of Virginia (79)
American Hard Rubber Co. (303–305)
Bartlett & Snow Co., C. O. (427–428)
Blickman, Inc., S. (474–475)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Haveg Corp. (51)
Heil Process Equipment Corp. (575)
Kewaunee Mfg. Co. (44A–45)
Laboratory Furniture Co., Inc. (221–223)

(*Continued on page* 354)

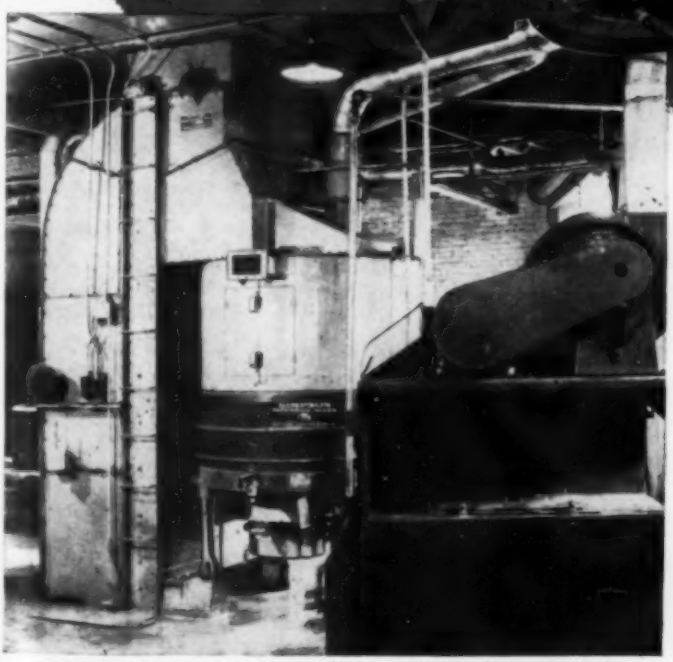
Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

there are

SIMPSON *Intensive* MIXER models

for every "special" application of straight production mixing requirement up to

50 cu. ft. batches



ABOVE: Typical "standard" production size Simpson Mixer, equipped with a totally enclosed loader, and combination dust and cooling hood for handling dusty, corrosive or poisonous materials.

NO matter what your chemical process mixing requirements may be . . . there is a SIMPSON Intensive MIXER model qualified to handle the job, within a range of capacities from 1/5 to 50 cubic feet per batch.

All models offer the superior "mulling" principle of controlled mixing, to blend all types of dry, semi-dry and plastic materials better, faster at lower cost. In addition, SIMPSON MIXERS are available with all necessary equipment for use as reaction vessels, where reactions, heating, cooling, etc., can be completely controlled.

Ask to have a National Engineer show you how Simpson Intensive Mixers can solve your most complex mixing problems, resulting in higher production, lower costs.

SIMPSON *Intensive Mixers*

NATIONAL ENGINEERING COMPANY

604 Machinery Hall Bldg. • Chicago 6, Ill.

SEE SIMPSON INTENSIVE MIXERS AT THE CHEMICAL EXPOSITIONS.

SAN FRANCISCO
Booth 82

NEW YORK
Booths 554-555

Manufacturers and Selling Agents for Continental European Countries—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia—August's Limited, Halifax, England. For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd., Sydney, Australia

Planning new corrosion resistant processing equipment? Keep in mind that between blue print and finished vessel the experience, skill and plant of your fabricator may determine how much return you get from your investment—how long and how well it will serve in your plant for your special applications.

We are specialists in stainless steel and alloy fabrication – work exclusively with these metals. Our experienced staff of engineers and mechanics – the special tools, dies and machinery we use – give you increased returns from your expenditures for stainless steel equipment. Consult with us.

S. BLICKMAN, INC. • 611 GREGORY AVENUE • WEEHAWKEN, N. J.

Booth 474—475

S. BLICKMAN, INC.
Guards Alloys in Fabrication

SEND FOR THIS VALUABLE BOOK

A request on your letterhead will bring our guide, "What to Look For When You Specify Stainless Steel for Your Processing Equipment."

EXHIBITORS
Classified by Products
CONTINUED

Metalab Equipment Corp. (462–464)
Sheldon & Co., E. H. (255)
Sjostrom Co., John E. (664)
U. S. Stoneware Co., (89 to 91)

HUMIDIFYING APPARATUS

American Instrument Co., The (385-387)
Electric Hotpack Co., Inc., The (655-656)
Grinnell Co., Inc. (251)
Niagara Blower Co. (233–235)

INDICATORS

American Meter Co. (39–41)
Bailey Meter Co. (274–276)
Builders-Providence, Inc. (479)
Eimer & Amend (57)
Fischer & Porter (203 to 207)
Fischer Scientific Co. (57)
Fuller Co. (315–317)
Jacoby-Tarbox Corp. (540–542) flow
Mine Safety Appliances Co. (376–378) gas
National Technical Laboratories (265 to 268)
Photoswitch, Inc. (603)
Reliance Electric & Engr. Co. (674–675)
Uehling Instrument Co. (356)
Weston Electrical Instrument Corp. (263)

INSTRUMENTS—Optical

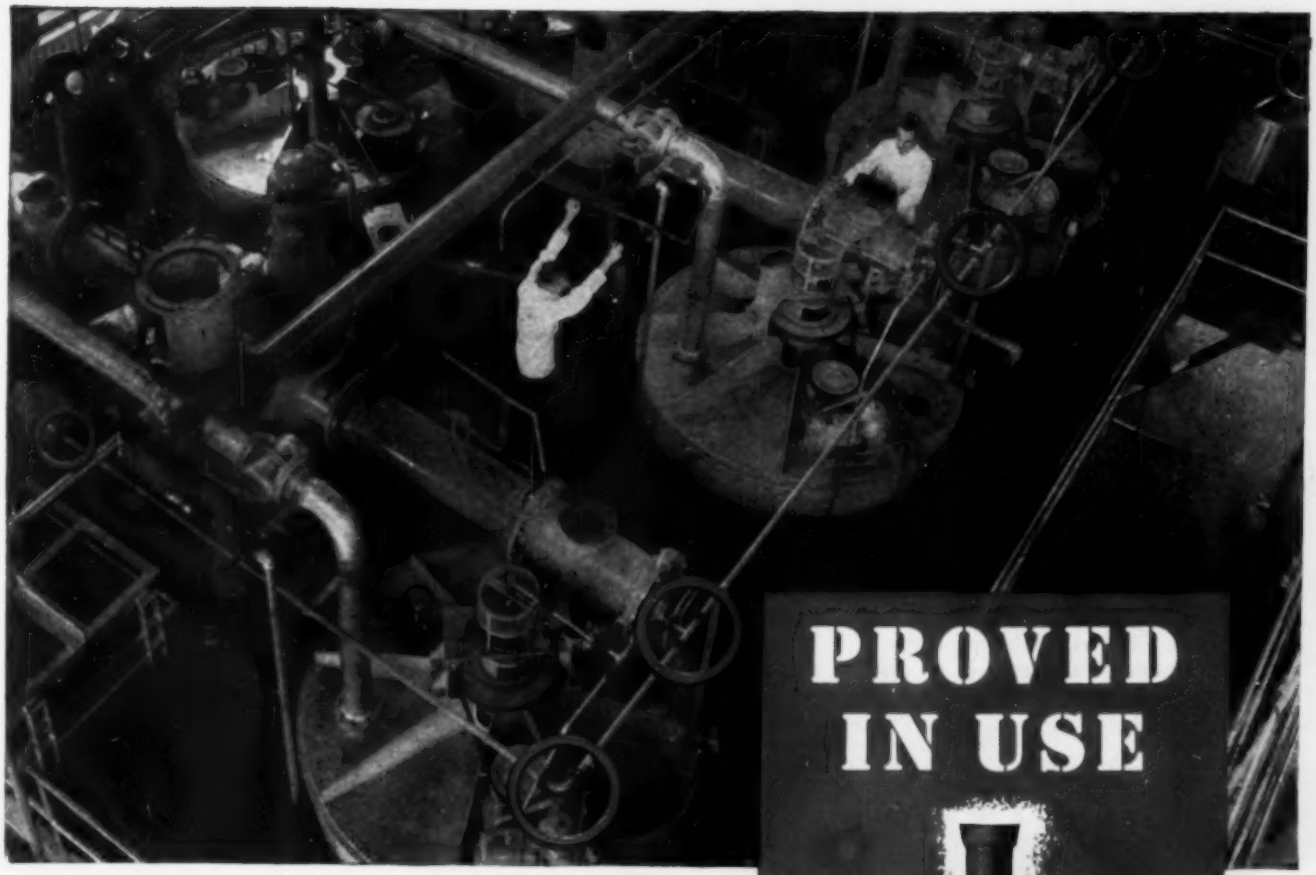
Baird Associates, Inc. (610)
Eimer & Amend (57)
Fischer & Porter Co. (203 to 207)
Fischer Scientific Co. (57)
Gamma Scientific Co. (497)
National Technical Laboratories (265 to 269)
Perkin-Elmer Corp., The (442)
Photovolt Corp. (270)
Process & Instruments (518)
Will Corp. (667–668)
Willson Products, Inc. (419–420)

INSTRUMENTS—Testing

Aetna Scientific Co. (218)
American Instrument Co., The (385-387)
American Meter Co. (39–41)
Baird Associates, Inc. (610)
Brabender Corp. (272)
Brookfield Engrg. Laboratories (601C)
Carver, Inc., Fred S. (237)
Coleman Instruments, Inc. (381 & A)
Denver Equipment Co. (507)
Eimer & Amend (57)
Electric Hotpack Co., Inc., The (655-656)
Engelhard, Inc., Charles (455)
Fischer & Porter Co. (203 to 207)
Fischer Scientific Co. (57)
Gamma Scientific Co. (497)
General Electric Co. (4)
Greiner Co., The Emil (226–228)
Hart-Moisture-Meters (573A)
Industrial Instruments, Inc. (410)
Macbeth Corp. (201)
Meriam Instrument Co., The (512-513)
National Technical Laboratories (265 to 269)
North American Phillips Co., Inc. (539)
Perkin-Elmer Corp., The (442)
Photovolt Corp. (270)
Process & Instruments (518)

(*Continued on page* 356)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.



Tri-Clover *Conical End* Fittings provide CORROSION-RESISTANT Conveying Lines at LOWER COST

Illustrated above is one of the increasing number of large liquid conveying line installations assembled with Tri-Clover stainless steel type 316 Conical End fittings throughout. This installation, at the Plymouth, Fla., plant of Vacuum Foods, Inc., has attracted wide interest because of advanced engineering techniques employed.

Through the use of Tri-Clover Flanged Type Conical End fittings and stainless steel light gauge tubing, companies like this are realizing tremendous savings in engineering and installation costs. In addition, they are assured of longer fitting and line life, freedom from leakage, and complete protection against product contamination.

Get the full story now. Send for complete catalog 847.

Tri-Clover MACHINE CO.
Kenosha, Wisconsin

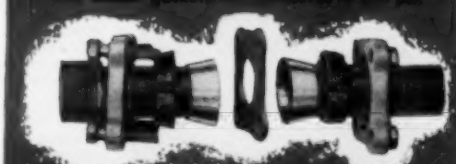
TRIALLOY AND STAINLESS STEEL SANITARY FITTINGS, VALVES, PUMPS, TUBING, SPECIALTIES

FABRICATED STAINLESS STEEL INDUSTRIAL FITTINGS AND INDUSTRIAL PUMPS

THE Complete LINE

PROVED IN USE

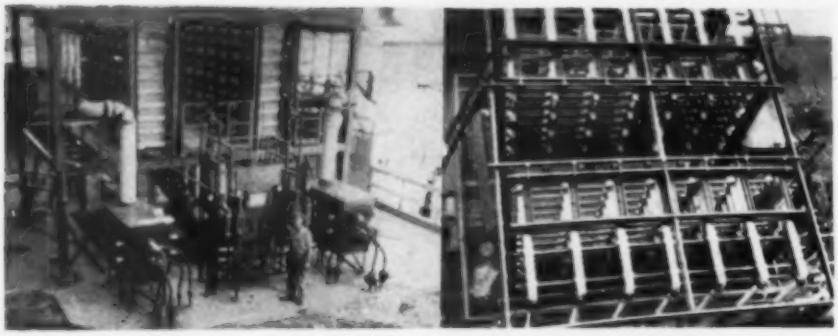
Tri-Clover Stainless Steel Conical End fittings are available in a complete line of ells, tees, crosses, returns, reducers, etc., from 1" thru 10" O. D. Shown below is the fast method of assembling, through look tight flanges and simple gaskets. Any pressures to 250 psi.



Be sure to see the Tri-Clover Exhibit at the New York Chemical Exposition . . . BOOTHS 567-568.

Ask about Zephyrweld
STAINLESS STEEL WELDING FITTINGS
for permanent installations...

Available in a complete line, in sizes from 1" O. D. through 24" O. D., fabricated from stainless steel type 304, 316 or 347*. No mitre joints—sweep ell design—no internal threads or pockets—joints are flush.
(*Above 4" only 316 or 347).



AMERSIL* ENGINEERING SERVICE CARRIES THROUGH

From the moment you first talk with an Amersil Engineer—AMERSIL'S ENGINEERING SERVICE goes into high gear—on research, development and design to fit major and auxiliary silica ware units to your particular problem.

Whether you require a BIG plant, such as the 60-ton HCl unit above, capable of handling 2½ tons of 22° Bé. acid an hour, or an auxiliary unit to handle a laboratory experiment, AMERSIL ENGINEERING SERVICE offers one high standard of quality and design — under one contract — one responsibility.

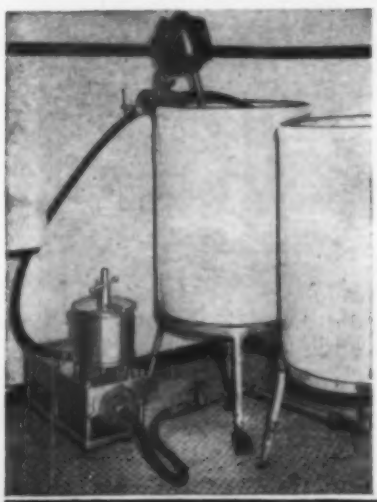
*Trade Name Registered

See our exhibit
21st Exposition of Chemical Industries
at Grand Central Palace

AMERSIL COMPANY Inc.
ENGELHARD
CHESTNUT AVENUE HILLSIDE 5, N. J.

Save TIME and LABOR

ALSOP "Hy-Speed" MIXERS AND FILTERS for all liquids



"Hy-Speed" Portable Mixers

Designed to meet your mixing and blending requirements on all liquids—based on 25 years mixing experience, the Alsop "Hy-Speed" Portable Mixer provides dependable, accurate and economical service that needs no supervision. Simply mount it to your present tank, its special clamp provides easy adjustment for any mixing action and makes every tank a mixing tank.

Compact "Sealed-Disc" Filters

Provide positive filtration at all times with low operating, cleaning and maintenance cost. These unique filters are air-tight and leak-proof, recommended for intermittent or continuous operation on chemicals, liquid plastics, plating solutions, alcohol, acids, drugs, syrups, water etc. Available in Stainless Steel, Monel, Nickel Plated Brass and Bronze, in sizes from 1 g.p.m. to thousands of g.p.h.

Available for inspection at our booth #293 at the Chemical Show.

Write for catalog #745 showing our complete line of Top Entering type Mixers and Fixed Side-Entering Agitators, The Alsop Engineering Corporation, 211 White Road, Milldale, Connecticut.

ALSOP ENGINEERING CORPORATION
Filters, Filter Discs, Pumps, Tanks, Mixers, Agitators

BOOTH 308-310

EXHIBITORS
Classified by Products
CONTINUED

Rubicon Co. (380)
Scientific Glass Apparatus Co., Inc (215 to 219)
Sederer-Kohlbusch, Inc. (389)
Superior Electric Co. (522–523)
Tech Laboratories, Inc. (400A)
Welch Scientific Co., W. M. (405)
Weston Electrical Instrument Corp (263)
Will Corp. (667–668)
Willson Products, Inc. (419–420)

INSTRUMENTS OF PRECISION
American Instrument Co. (385–387)
American Meter Co. (39–41)
Brabender Corp. (601C)
Cambridge Instrument Co. Inc. (330–332)
Eimer & Amend (57)
Engelhard, Inc., Charles (455)
Fischer & Porter Co. (203 to 207)
Fischer Scientific Co. (57)
Industrial Instruments, Inc. (410)
Martindale Electric Co. (440)
National Technical Laboratories (265 to 269)
North American Phillips Co., Inc. (539)
Photovolt Corp. (270)
Process & Instruments (518)
Rubicon Co. (380)
Scientific Glass Apparatus Co., Inc. (215 to 219)
Scott Electroflux Co. (601B)
Sederer-Kohlbusch, Inc. (389)
Tech Laboratories, Inc. (400A)
Technicon Co., The (640B)
Weston Electrical Instrument Corp. (263)
Will Corp. (667–668)

INSULATING MATERIAL—Heating, Electric & Molded
Amersil Co., Inc. (454)
American Hard Rubber Co. (303–305)
Haveg Corp. (51)
Illinois Electric Porcelain Co. (672–673)
Johns-Manville Corp. (93–94)
Dicalite Co., The (86–87)
Munn & Steele, Inc. (406)
Owens-Corning Fiberglas Corp. (437–438)
Titanium Alloy Mfg. Co. (366–368)

INSULATION—Furnace
Dicalite Co., The (86–87)
Johns-Manville Corp. (93–94)
Munn & Steele, Inc. (406)
Owens-Corning Fiberglas Corp. (437–439)

KETTLES
Andrews-Knapp Construction Co., Inc. (23) lead
Artisan Metal Products, Inc. (540–542) non-ferrous, stainless
Blickman, Inc., S. (474–475) stainless steel
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Eclipse Fuel Engr. Co. (504) lard rendering
Eppenbach, Inc. (289)
General Ceramics & Steatite Corp. (2) stoneware, porcelain
Glascote Products, Inc. (657–658) glass lined
Industrial Process Engineers (441) chemical industries

(*Continued on page* 359)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

EXHIBITORS
Classified by Products
CONTINUED

Industrial Steels, Inc. (650) stainless steel
Knapp Mills, Inc. (23) lead
Knight, Maurice A. (53)
Koven & Bro., Inc., L. O. (304–306) all
Metal-Glass Products Co. (425–426) stainless steel
Patterson-Kelley Co., Inc., The (248) stainless steel
Pfaudler Co., The (72–75) glass lined
Rodgers Co., Inc., George G. (679) stainless steel
Stokes Machine Co., F. J. (80) vacuum
Trent, Inc. (526–527)
U. S. Stoneware Co. (89 to 91) boiling
Welding Engineers, Inc. (407–408) chemical industry

KILNS
Allis-Chalmers Mfg. Co. (48–49) rotary
Bartlett & Snow Co., C. O. (427–428) rotary
Electric Hotpack Co., Inc., The (655–656) electric
General American Transportation Corp. (285–287)
Hardinge Co., Inc. (60) rotary

LABELING MACHINES
Economic Machinery Co. (545–546)
New Jersey Machine Corp. (485–486)
Norton Co. (415–416)
Pneumatic Scale Corp., Limited (22)

LABORATORIES—Testing
American Meter Co. (39–41)
Baird Associates, Inc. (610)
Denver Equipment Co. (507)
Dorr Co., The (64–65)
Federal Classifier Systems, Inc. (404)
Great Western Mfg. Co. (372–374)
Snell, Inc., Foster D. (37)

LABORATORY APPARATUS & SUPPLIES
Alsop Engineering Corp. (293) filters and mixers)
American Instrument Co. (385–387)
American Meter Co. (39–41)
Amersil Co., Inc. (454)
Baird Associates, Inc. (610)
Barnstead Still & Sterilizer Co., Inc. (229–231)
Brookfield Engrg. Laboratories (601C)
Carver, Inc., Fred S. (237)
Corning Glass Works (391 to 393)
Denver Equipment Co. (507)
Eimco Corp., The (605–606)
Eimer & Amend (57)
Electric Hotpack Co., Inc., The (655–656)
Eppenbach, Inc. (289)
Federal Classifier Systems, Inc. (404)
Fischer Scientific Co. (57)
Gamma Scientific Co. (497)
Great Western Mfg. Co. (372–374)
Greiner Co., The Emil (226–228)
Hercules Filter Corp. (443 to 445) filters
Hoke, Inc. (213)
Kimble Glass Div. of Owens-Illinois Glass Co. (342–344) glassware
Luzerne Rubber Co. (528–529)
Macbeth Corp. (201)
Micro Metallic Corporation (671)
Mixing Equipment Co., Inc. (307–309, 334–336)
National Technical Laboratories (265 to 269)

(*Continued on page* 360)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

At "The Show of Tomorrow"

New SHRIVER DEVELOPMENTS for Better Filtration

NEW **ENCLOSED PRESSURE FILTER**

Portable — Fool-proof — Sanitary

Tank never under pressure; no unfiltered material in tank, which is easy to flush clean; filter cartridge may be quickly removed as a unit or in individual plates. Light, quick closing cover on tank, and easy closing hydraulic mechanism for filter unit. Filter plates strong and rigid; stainless steel or other alloy construction.

NEW **HYDRAULIC CLOSING DEVICE**

for Any Type of Filter Press

Simple to Install · Easy to Operate
Saves Closing Time and Labor

Closes any size press tight with a few light strokes of a hand pump; eliminates need for ratchet, gear and pinion and use of tommy bar, strain on workmen and possibility of damage to parts. As easy as push button operation.

NEW **PLASTIC FILTER PRESS**

for Corrosive or Delicate Materials

Lightweight, translucent; smooth, easily cleaned surface; resistant to high temperature; costs less than most corrosion resistant alloys and more widely applicable.

Be Sure to Visit
BOOTH No. 12
at the
Chemical Exposition
Dec. 1-6

or Write for Catalogs

T. SHRIVER & COMPANY, Inc.
802 HAMILTON STREET · HARRISON, N. J.

The PerfeKtum AMPFIL

A scientifically designed apparatus for the rapid filling of ampuls, vials, bottles and similar containers, used in the pharmaceutical industries, wherein accurate, repeated and speedy measurements of pre-determined quantities of fluid are required to be introduced into the above containers. The PerfeKtum AMPFIL is semi-automatic, easily adjustable and can handle all types of liquids ranging from aqueous solutions to light oils. Available in three sizes: 10 cc, 50 cc and 500 cc.

Write for literature on the AMPFIL and our other ampul sealing and washing equipment.

PerfeKtum
PRODUCTS COMPANY
Serving Industry for 25 Years
300 Fourth Avenue New York 10, N. Y.

EXHIBITORS • Classified by Products • CONTINUED

North American Phillips Co., Inc. (539)
Oliver United Filters, Inc. (65–66)
Newark Wire Cloth Co. (83–84)
Palo-Myers, Inc. (642)
PerfeKtum Products Co. (209–211)
Photovolt Corp. (270)
Pioneer Rubber Co., The (429)
Precision Scientific Co. (601D)
Pulverizing Machinery Co. (300–302)
Richmond Mfg. Co. (519)
Rubicon Co. (380) electrical
Scientific Glass Apparatus Co., Inc. (215 to 219)
Seederer-Kohlbusch, Inc. (389)
Sparkler Mfg. Co. (516–517) laboratory filters
Standard Scientific Supply Corp. (618)
Selas Corp. of America (533–534)
Stokes Machine Co., F. J. (80)
Sturtevant Mill Co. (3)
Superior Electric Co. (522–523)
Technicon Co., The (640B)
Thomas Co., Arthur H. (665–666)
Trent, Inc. (526–527)
Tyler Co., The W. S. (88)
U. S. Stoneware Co. (89 to 91)
Welch Scientific Co., W. M. (405)
Weston Electrical Instrument Corp. (263)
Wiegand Co., Edwin L. (634)
Will Corp. (667–668)

LABORATORY FURNITURE
Alberene Stone Corp. of Virginia (79)
Eimer & Amend (57)
Fischer Scientific Co. (57)
Johns-Manville Corp. (93–94)
Kewaunee Mfg. Co. (44A–45)
Laboratory Furniture Co., Inc. (221–223)
Metalab Equipment Corp. (462–464)
Norton Co. (415–416) laboratory ware
Sheldon & Co., E. H. (255)
Sjorstrom Co., John E. (664)
Welch Scientific Co., W. M. (405)

LACQUERS
American Resinous Chemicals Corp. (35–36)
Atlas Powder Co. (46–47)
Darco Corp. (46–47)
Knight, Maurice A. (53)
Hercules Powder Co., Inc. (W. Pt. 7)
U. S. Stoneware Co. (89 to 91)

LAMPS
Eimer & Amend (57)
Fischer Scientific Co. (57)
Gamma Scientific Co. (497)
Hanovia Chemical & Mfg. Co. (457–458)
Standard Scientific Supply Corp. (618) balances & laboratory

LEAD BURNING & COATING
Andrews-Knapp Construction Co., Inc. (23)
Heil Process Equipment Corp. (575)
Hoke, Inc. (213)
Knapp Mills, Inc. (23)
Lead Lined Iron Pipe Co. (23)
U. S. Stoneware Co. (89 to 91)

LOADERS
Eimco Corp., The (605–606)
Ingersoll-Rand Co. (615–617)

MAGNETIC SEPARATORS
Eriez Mfg. Co. (631)
Jeffrey Mfg. Co. (44A-45)
Richmond Mfg. Co. (519)
Sprout, Waldron & Co. (550 to 553)

MATERIALS HANDLING EQUIPMENT
Barrett-Cravens Co. (239)
Bartlett & Snow Co., C. O. (427–428)
Cargocaire Engrg. Corp. (621)
Denver Equipment Co. (507)
Ferguson Co., Harry J. (601-602)
Falstrom Co. (510-511) barrel lift, steel cubicles
Gump Co., B. F. (362–364)
Hyster Co. (573–574)
Luzerne Rubber Co. (528-529)
National Engineering Co. (554-555)
Omega Machine Co. (480)
Rapids-Standard Co. Inc., The (446 to 450)
Read Machinery—Div. of Standard Stoker Co. (280)
Sprout, Waldron & Co. (550 to 553)
Syntron Co. (311–313)
United States Stoneware Co. The (89 to 91)
Yale & Towne Mfg. Co., The (278)

METAL COATING AND PLATING
Andrews-Knapp Construction Co. (23)
Baker & Co. Inc. (451–452)
Haveg Corp. (51)
Knapp Mills, Inc. (23)
Koppers Co. Inc. (264)
Lead Lined Iron Pipe Co. (23)
Magna Mfg. Inc. (609)
Process & Instruments (518)

METAL CONTAINERS
Aluminum Co. of America (70–71)
Andrews-Knapp Construction Co. Inc. (23)
Knapp Mills, Inc. (23)
Koven & Bro. Inc., L. O. (304-306
Pressed Steel Tank Co. (348 to 352)
Republic Steel Corp. (434–436)
United States Steel Corp. (76–77)

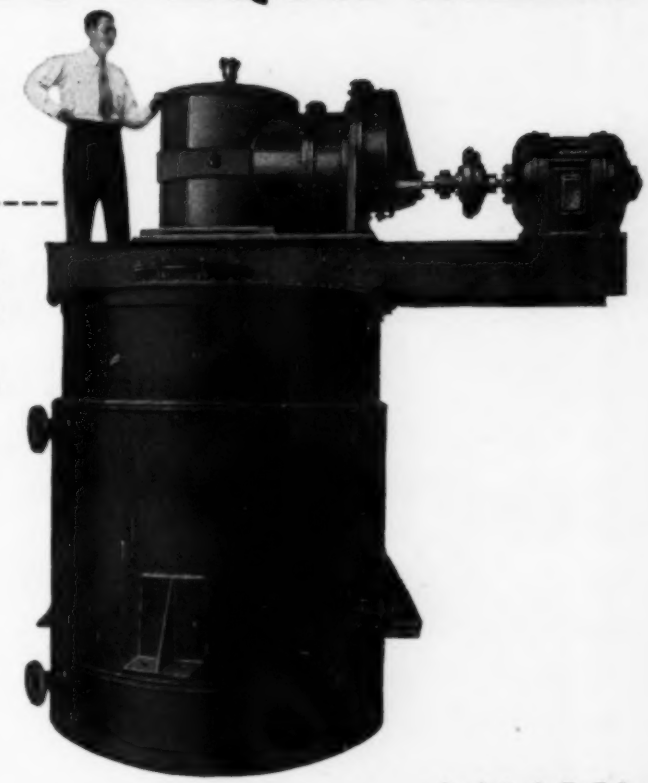
METALS
Allegheny Ludlum Steel Corp. (250–252–254)
Aluminum Co. of America (70–71)
American Platinum Works (456)
Baker & Co. Inc. (451–452) precious
Andrews-Knapp Construction Co. Inc. (23)
Fansteel Metallurgical Corp. (282–284) molybdenum, tantulum, tungsten
Industrial Steels, Inc. (650) stainless steel
International Nickel Co. (9–10)
Knapp Mills, Inc. (23)
Lukens Steel Co. By-Products Steel Corp. (558 to 563)
Makepeace Co., D. E. (453)
National Lead Co. (247) lead, tin, zinc
National Research Corp. (472–473) vacuum treated
Pressed Steel Tank Co. (348 to 352) mild or alloy
Republic Steel Corp. (434–436)
United States Steel Corp. (76–77)
Will Corp. (667–668)

METERS
American Meter Co. (39–41) gas and air
Bailey Meter Co. (274–276) flow, pressure, temperature
Builders–Providence, Inc. (479) flow
Carpenter Steel Co. Alloy Tube Div. (491–492)
Coleman Instruments, Inc. (381–381A) pH

(*Continued on page 362*)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

FOR 'PRECISION-ENGINEERED' PROCESS PLANTS & EQUIPMENT LOOK TO I★P★E



LOOK FOR THIS GREEN STRIPE

—The I★P★E Seal of Warranty on equipment

Built—to last
Built—of warranted materials fitted to *your* needs
Built—to precise I★P★E standards
Built—to advanced engineering and design specifications
Built—to do more with less outage

LOOK FOR

1 **ENGINEERING.** I★P★E equipment—both complete plants and individual units—incorporates sound *engineering*. Result: equipment created *functionally* to fit your own manufacturing process . . . simplified plant layout . . . and in many instances, a better product. I★P★E's broad engineering experience has resulted in major improvements in standard equipment used by the process industries. Our technological skills often incorporate both engineering and design improvements, particularly when special process equipment is "tailored" to your particular manufacturing process.

2 **DESIGN.** I★P★E process equipment represents advanced design improvements and features. I★P★E designing boards go to work, stripping equipment down to fundamentals, adding only those design improvements that offer greater efficiency. Such functional simplicity pays off in lower maintenance cost, less trouble shooting, longer equipment life and less outage!

If Production Is Holding Up Your Orders— Remember I★P★E Delivers Equipment On Time

IF YOU ARE flooded with post war orders . . . if even full time production finds you unable to keep up with your orders, consider this: have I★P★E analyze your production process—make suggestions that will help you step up output through the addition of new process equipment.

MANY NATIONAL MANUFACTURERS have been able to increase production within a short period of time by calling in I★P★E as "process equipment counsel," for each I★P★E installation recommended is handled as a specific problem closely related to your product, rate of production, and physical condition encountered...and delivery of the equipment is made ON TIME! I★P★E has been the first to design certain types of chemical processing equipment that have become the standard for the industry. We have "tackled" and solved engineering problems attempted by few other manufacturers.

I★P★E's STAFF is at your disposal without obligation . . . why not write, phone or wire today?

Look to I★P★E for

Agitators
Agitator Drives
Autoclaves
Chemical Process Equipment
Complete Process Plants
Condensers
Conical Dry Blenders
Continuous Processing Units
Digesters
Dissolvers
Dowtherm Kettles
Electric Kettles
Extruders
Gas Absorbers
Grease Mixers
Heat Exchangers
Horizontal Mixers
Jacketed Processing Units
Kettles
Mixers
Nitrators
Paint Mixers
Paste Mixers
Soap Crutchers
Side Entering Agitators
Special Machinery
Special Valves
Stills
Synthetic Resin Plants
Turbine Agitated Units
Vacuum Kettles & Mixing Equipment

I·P·E precision engineered design

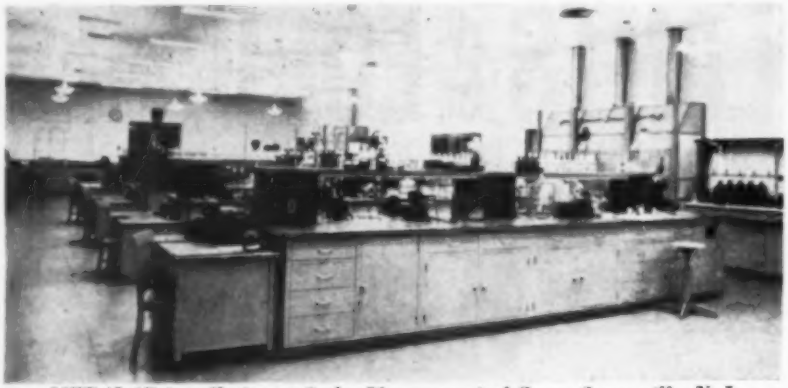
"Special and Standard Process Equipment Engineered to Your Requirements"

INDUSTRIAL PROCESS ENGINEERS

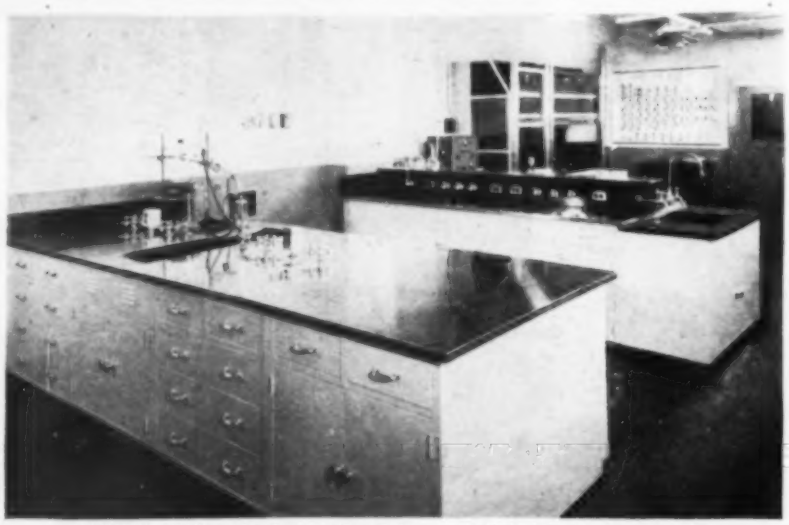
5200 HUDSON AVENUE, WEST NEW YORK, N. J.

LABORATORY FURNITURE by METALAB

In Many of the Country's Finest Laboratories



METALAB installation at Ortho Pharmaceutical Corp., Somerville, N. J.



METALAB installation at Naval Research Lab, Washington, D. C.

Features:

FIREPROOF—Safe, all metal and stone.
WATERPROOF—Unaffected by steam, moisture, or water.
RUGGED—Structurally solid, chemically resistant.
EASY OPERATING—Doors or drawers will never stick.
ADAPTABLE—There is a standard design for every need.
ECONOMICAL—In its initial cost. Maintenance cost is negligible.

The above installations are typical examples utilizing Sectional Units resulting in a "Custom-Built" installation to fit the individual requirements.

Send for the New Metalab Catalog including:—
Laboratory Tables, Storage Cabinets, Fume Hoods, Sink Fixtures, Balance Tables, Microscope Tables, Titration Tables, Dark Room Tables, Developing Sinks, Drying Cabinets, Constant Temperature Cabinets, Condenser Racks, Sample File Cabinets, Steam Baths, Water Baths, Chemists Desks, Museum-Display Cases, Ventilation-Canopies and Air Conditioned Hoods, etc.

SEE US AT THE CHEMICAL SHOW: Be sure to visit us in Booth Nos. 462-463-464 on the 3rd Floor, Grand Central Palace, New York, N. Y. at the 21st Exposition of Chemical Industries, December 1-6, 1947.

METALAB EQUIPMENT CORP.

1533 DEAN STREET, BROOKLYN 13, N. Y.

EXHIBITORS
Classified by Products
CONTINUED

Fischer & Porter Co. (203 to 207) flow rate
Hart-Moisture-Meters (573A) moisture
Merian Instrument Co., The (512-513) flowmeter
National Technical Laboratories (265 to 269) pH
Nordstrom Valve Div-Rockwell Mfg. Co. (61) gas
%Proportioneers, Inc.% (477-478)
Scientific Glass Apparatus Co. Inc. (215 to 219) pH
Tech Laboratories, Inc. (400A) viscosity
Welch Scientific Co., W. M. (405) electric
Will Corp. (667-668) amperes, voltage

MICROSCOPES

Eimer & Amend (57)
Gamma Scientific Co. (497)
Fisher Scientific Co. (57)
Radio Corp. of America-Victor Div. (627-628)
Scientific Glass Apparatus Co. Inc. (215 to 219)
Standard Scientific Supply Corp. (618)
Welch Scientific Co., W. M. (405)
Will Corp. (667-668)

MILLS

Allis-Chalmers Mfg. Co. (48-49) grinding, flaking, roller, hammer
Bramley Machinery Corp. (524-525) Bramley
Chemicolloid Laboratories, Inc. (257) colloid
Combustion Engineering Co. Inc. Raymond Pulverizer Div. (67) pulverizing
Denver Equipment Co. (507) ball, cyanide, flotation, gravity, grinding, pebble, rod
Eppenbach, Inc. (289) colloid
Gump Co., B. F. (362-364) hammer
Hardinge Co. Inc. (60) ball, pebble, rod & tube
Marco Co. Inc. (646-647) kombinators
Premier Mill Corp. (312-314) grinding
Pulverizing Machinery Co. (300-302)
Scientific Glass Apparatus Co. Inc. (215 to 219) ball
Sprout, Waldron & Co. (550 to 553) hammer, attrition, roller, pellet, binder
Will Co p. (667-668) lab. grinding

MINERALS

Foote Mineral Co. Inc. (607-608)
Titanium Alloy Mfg. Co. (366-368) zircon, butile
Will Corp. (667-668)

MIXING & KNEADING MACHINERY

Alsop Engineering Corp. (293) Hy-speed
American Tool & Machine Co. (412)
Baker Perkins, Inc. (62-63)
Bramley Machinery Corp. (524-525)
Cowles Co. Inc., The (572)
Dorr Co., The (64-65)
Eastern Industries, Inc. (220 to 224)
Electro Chemical Supply & Engr. Co. (81)
Eppenbach, Inc. (289)
General American Transportation Corp. (285-287)

(*Continued on page* 366)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

BEMIS

Headquarters for All Types of Bags for the CHEMICAL INDUSTRY

MULTIWALL PAPER SHIPPING SACKS

Tough, siftproof, will withstand rough handling. Quality controlled throughout all manufacturing operations.

WATERPROOF LAMINATED TEXTILE BAGS

Tear-resistant, puncture-resistant, siftproof, moistureproof. Ideal for chemicals needing extra protection.

COTTON BAGS

Made by expert workmen from quality cloth. Especially favored because of the high salvage value of these sturdy bags.

BURLAP BAGS

Select burlap sewn with quality thread and close-stitched to make seams that are stronger than the burlap itself.

BEMIS BRO. BAG CO.

Baltimore • Boise • Boston
Brooklyn • Buffalo • Chicago
Charlotte • Denver • Detroit
East Pepperell • Houston
Indianapolis • Kansas City
Jacksonville, Fla. • Memphis
St. Helens, Ore. • St. Louis • Salt Lake City • San Francisco • Seattle • Wichita
Wilmington, California

Los Angeles • Louisville
Minneapolis • New Orleans
Mobile • New York City
Norfolk • Oklahoma City
Orlando • Omaha • Peoria
Phoenix • Pittsburgh • Salina

See DeBothezat Bifurcators

AT THE 21st EXHIBITION OF CHEMICAL INDUSTRIES NEW YORK, DECEMBER 1-6

- **FOR EXHAUSTING** air or gases that are abnormally hot, corrosive, inflammable or explosive.
- **MOTOR IS MOUNTED** in separate through - ventilated chamber completely isolated from air stream. Destructive fumes are by-passed (bifurcated) around motor.
- **INSTALLS IN DUCT** in any position from horizontal through vertical.
- **FAN WHEELS** 16" through 48" in diameter.

Visit **OUR DISPLAY AT BOOTHS 68 - 69, 21st EXHIBITION OF CHEMICAL INDUSTRIES, DECEMBER 1-6**

DeBothezat Fans

Division of

American Machine and Metals, Inc.

EAST MOLINE, ILLINOIS

EXHIBITORS • Classified by Products • CONTINUED

Hormann & Co., Inc., F. R. (680) portable, electric
Industrial Process Engineers (441)
Koven & Bro. Inc., L. O. (304–306)
Marco Co. Inc. (646–647)
Mixing Equipment Co. Inc. (307–300–334–336)
National Engr. Co. (554–555)
New England Tank & Tower Co. (50)
Read Machinery–Div. of Standard Stoker Co. (280)
Rodgers Co. Inc., George G. (679)
Sprout, Waldron & Co. (550 to 552)
Stokes Machine Co., F. J. (80)
Struthers Wells Corp. (662A)
Sturtevant Mill Co. (3)
Turbo–Mixer Corp. (285–287)
United States Stoneware Co., The (89 to 91)
Welding Engineers, Inc. (407–408)

MOLDING MACHINERY

Carver, Inc., Fred S. (237)
Stokes Machine Co., F. J. (80)

MOTORS—Electric

Allis–Chalmers Mfg. Co. (48–49)
Allis Co., The Louis (320–322)
Eimer & Amend (57)
Fisher Scientific Co. (57)
General Electric Co. (4)
Great Western Mfg. Co. (372–374)
Reeves Pulley Co. of N. Y. Inc. (34)
Reliance Electric & Engr. Co. (674–675)

NAVAL STORES

Coleman Instruments, Inc. (381–381A) nephelometer
nephelometer
Hercules Powder Co. Inc. W. Pt. (7)

NITRATORS

Buflovak Equipment Div. of Blaw–Knox Co. (6)
General Ceramics & Steatite Corp. (2)
Glascote Products, Inc. (657–658)
Industrial Process Engineers (441)
Knight, Maurice A (53)

NOZZLES—Spray

Andrews–Knapp Construction Co. Inc. (23)
Blaw Knox Div. of Blaw–Knox Co. (13–14)
Grinnell Co. Inc. (251)
Haveg Corp. (51)
Knapp Mills, Inc. (23)
Luzerne Rubber Co. (528–529)
Monarch Mfg. Works, Inc. (354)
Schutte & Koerting Co. (291)

OVENS—Electric, Laboratory

American Instrument Co. The (385–387)
Denver Equipment Co. (507)
Eimer & Amend (57)
Electric Hotpack Co. Inc., The (655–656)
Fisher Scientific Co. (57)
Falstrom Co. (510–511) special only
Palo Myers, Inc. (642)
Scientific Glass Apparatus Co. Inc. (215 to 219)
Standard Scientific Supply Corp. (618)
Stokes Machine Co., F. J. (80)
Trent, Inc. (526–527)
Welch Scientific Co., W. M. (405)
Will Corp. (667–668)

OVENS—Industrial

Selas Corp. of America (533–534)
Trent, Inc. (526–527)

PACKING

Baldwin Belting, Inc. (662)
Garlock Packing Co. (244)
Jeffrey Mfg. Co. (44A–45)
Johns–Manville Corp. (93–94)

PACKAGING EQUIPMENT & SUPPLIES

Atlas Powder Co. (46–47)
Carpenter Container Corp. (261)
Darco Corp. (46–47)
Davidson Chemical Corp. (622–624)
Ertel Engr. Corp. (508–509)
Exact Weight Scale Co. (476)
Fitzpatrick Co., The W. J. (401–402)
Glengarry Machine Works, Inc. (659–660)
Gump Co., B. F. (362–364)
Horix Mfg. Co (413–414)
Kiefer Machine Co., The Karl (24)
M. R. M. Co. Inc. (638)
Marsh Stencil Machine Co. (411)
New Jersey Machine Corp. (485–486)
Pneumatic Scale Corp. Ltd. (22)
Republic Filters, Inc. (556–557)
Rodgers Co. Inc., George G. (679)
St. Regis Sales Corp. (531–532)
Syntron Co. (311–313)
Triangle Package Machinery Co. (514)
Tripard Mfg. Co. Inc. (411)

PAINT SPRAYING EQUIPMENT

Pressed Steel Tank Co. (348 to 352)

PAPER MACHINERY

Great Western Mfg. Co. (372–374)
Lukens Steel Co. By-Products Corp. Div. (558 to 563)
Sprout, Waldron & Co. (550 to 553)

PERFORATED METALS

Great Western Mfg. Co. (372–374)
Micro Metallic Corp. (671)

PETROLEUM PRODUCTS

Petroleum Specialties Inc. (471)
Will Corp. (667–668)
Socony-Vacuum Oil Co. Inc. (324–326)

pH EQUIPMENT

American Instrument Co., The (385–387)
Bailey Meter Co. (274–276)
Cambridge Instrument Co., Inc. (330–332)
Coleman Instruments, Inc. (381 A)
Eimer & Amend (57)
Fisher Scientific Co. (57)
Gamma Scientific Co. (497)
National Technical Laboratories (265–267)
Macbeth Corp. (201)
Palo Myers, Inc. (642)
Photovolt Corp. (270)
Roy Co., Milton (432–433)
Rubicon Co. (380)
Scientific Glass Apparatus Co. Inc. (215 to 219)
Standard Scientific Supply Corp. (618)
Thomas Co., Arthur H. (665–666)
Welch Scientific Co., W. M. (405)
Will Corp. (667–668)

PHARMACEUTICAL MACHINERY

American Tool & Machine Co. (412)
Eppenbach, Inc. (289)
Fitzpatrick Co., The W. J. (401–402)
Great Western Mfg. Co. (372–374)
Hercules Filter Corp. (443–445) filters

(*Continued on page* 367)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

EXHIBITORS • Classified by Products • CONTINUED

Industrial Process Engineers (441)
Kakso Co., The (461B)
M. R. M. Co. Inc. (638)
Marco Co. Inc. (646–647)
PerfeKtum Products Co. (209–211)
Proctor & Schwartz, Inc. (15)
Read Machinery–Div. of Standard Stoker Co. (280)
Republic Filters, Inc. (556–557)
Rodgers Co. Inc., George G. (679)
Selas Corp. of America (533–534)
Stokes Machine Co., F. J. (80)
Technicon Co., The (640B)
Tolhurst Centrifugals Div. American Machine & Metals, Inc. (68–69)

PIGMENTS

Dicalite Co., The (86–87) inert
Johns–Manville Corp. (93–94)
Magna Mfg. Co. Inc. (609)
National Lead Co. (247)
Reichhold Chemicals, Inc. (651 to 654)
Titanium Alloy Mfg. Co., The (366–368) ceramics

PIPE AND FITTINGS

Allegheny Ludlum Steel Corp (250 to 254) stainless
American Hard Rubber Co. (303–305) hard rubber, soft rubber, lined
Andrew-Knapp Constr. Co. Inc. (23) lead lined
Carpenter Steel Co., The Alloy Tube Div. (491–492) stainless
Corning Glass Works (391 to 393) glass
Crane Co. (297) iron, brass, steel
Durion Co. Inc., The (19–20) acid resisting
Fischer & Porter Co. (203 to 207) acid resisting
General Alloys Co. (299) stainless steel
Glascote Products, Inc. (657–658) glass lined
Globe Steel Tubes Co. (537–538) globeiron
Grinnell Co. Inc. (251) prefabricated–automatic sprinkler systems
General Ceramics & Steatite Corp. (2) stoneware, porcelain
Grove Regulator Co. (640D)
Haveg Corp. (51) plastic
Haynes Stellite Co. (92) corrosion resistant
Illinois Electric Porcelain Co. (672–673) porcelain
Industrial Steels, Inc. (650) stainless steel
International Nickel Co. (9–10) seamless
Knapp Mills, Inc. (23) lead lined
Knight, Maurice A. (53) acid proof
Lapp Insulator Co. Inc. (500–501) porcelain
Lead Lined Iron Pipe Co. (23) lead and tin lined
Luzerne Rubber Co. (528–529) hard rubber
National Carbon Co. Inc. (30–31) Karbate
National Lead Co. (247) lead
Parker Appliance Co., The (21)
Pfaudler Co., The (72–73) glass lined
Republic Steel Corp. (434–436) Stainless Steel
Taylor Forge & Pipe Works (530)
Trent Tube Mfg. Co. (644–645) stainless steel, Inconel
Tube Turns, Inc. (636–637) all metals
United States Steel Corp. (76–77)
United States Stoneware Co., The (89 to 91) stoneward
Walworth Co. (316–318) steel, iron, bronze and special alloys; threaded, flanged, & walseal
Watson-Stillman Co. (661) forged steel for chemical industry

PLASTICS

American Resinous Chemicals Corp. (35–36)
Bakelite Corp. (17–18)
Bramley Machinery Corp. (524–525) mixers
General American Transportation Corp. (285–287)
Haveg Corp. (51)
Hercules Powder Co. Inc. W. Pt. (7)
Koppers Co. Inc. (264)
Process & Instruments (518)
Reichhold Chemicals, Inc. (651 to 654)
St. Regis Sales Corp. (531–532) laminated
Sheffield Farms Co. Inc. (505) raw materials
U. S. Stoneware Co. The (89 to 91) United States

PLASTICIZERS

American Resinous Chemicals Corp. (35–36)
Atlas Powder Co. (46–47)
Carbide & Carbon Chemicals Corp. (17–18)
Commercial Solvents Corp. (55)
Darco Corp. (46–47)
Evens Chemetics, Inc. (461)
Glyco Products Co. Inc. (225–227)
Hardesty Chemical Co. Inc. (648–649)
Neville Co. (547–548)
Norton Co. (415–416) plates porous
Petroleum Specialties, Inc. (471)
Sonneborn Sons, Inc., L. (471)
Socony–Vacuum Oil Co. Inc. (324–326)

PLATINUM—Wire, Sheet, Foil, Crucibles, Laboratory Ware

American Platinum Works (456)
Eimer & Amend (57)
Engelhard, Inc., Charles (455)
Fisher Scientific Co. (57)
Scientific Glass Apparatus Co. Inc. (215 to 219)
Welch Scientific Co., W. M. (405)
Will Corp. (667–668)

PORCELAIN WARE

Bramley Machinery Corp. (524–525) Mixers
Eimer & Amend (57)
Fisher Scientific Co. (57)
General Ceramics & Steatite Corp. (2)
Illinois Electric Porcelain Co. (672–673)
Lapp Insulator Co. Inc. (500–501)
Scientific Glass Apparatus Co. Inc. (215 to 219)
Selas Corp. of America (533–534)
Standard Scientific Supply Corp. (618)
United States Stoneware Co., The (89 to 91)
Welch Scientific Co., W. M. (405)
Will Corp. (667–668)

PRESSES—Hydraulic

Carver, Inc., Fred S. (237)
Eimer & Amend (57)
Fisher Scientific Co. (57)
Will Corp. (667–668)
Stokes Machine Co., F. J. (80)

PRESSURE RELIEF & RUPTURE RELIEF DEVICES

American Instrument Co. (385–387)
Black, Sivalls & Bryson, Inc. (496)

(*Continued on page* 368)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

This new manual shows you exactly

How to use COLORS more effectively

FROM psychological effects of individual colors on people—to specific formulas for mixing colors to meet the requirements of artists, painters, decorators, etc.—this new manual brings together the important pointers you should know in order to apply colors for best effect. Compact and well illustrated, the book provides a unique yet simple system for speedy, accurate identification and selection of a wide variety of today's standard and popular hues, tints, tones, and shades—including 242 formulas for mixing them. Clear descriptions of each are given and 96 are shown in their exact color.

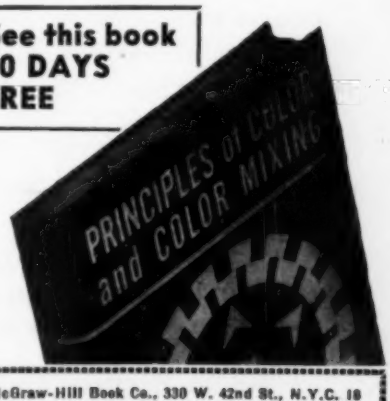
Just Published

PRINCIPLES OF Color and Color Mixing

By J. H. BUSTANOBY, Color Consultant
180 pages, 7¼ x 9⅝, illustrated with color charts, $4.50

THIS is an exceptionally useful guide for anyone concerned with making a discerning use of colors. Aside from the practical discussions of pigments, mediums and mixing procedures, it supplies scientific and usable facts on aesthetic values of color and the specific influence of color on our daily living. The book includes other important data on the legibility of colors, color combinations at a distance, and sensations caused by colors. A sound explanation of various color systems is given and the author's original color charts are furnished as a new kind of key to effective color matching and mixing.

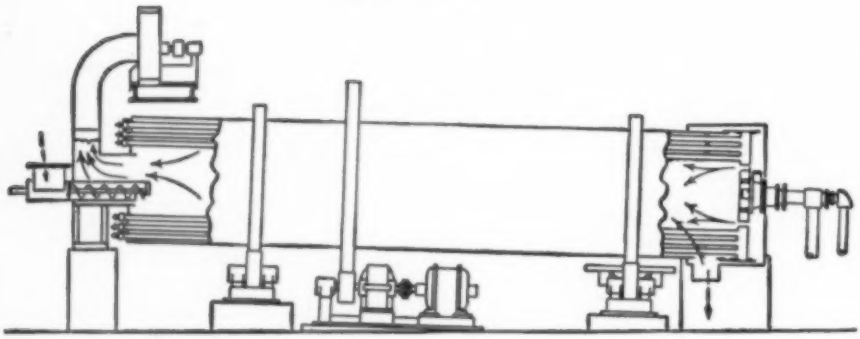
See this book 10 DAYS FREE



McGraw-Hill Book Co., 330 W. 42nd St., N.Y.C. 18
Send me Bustanoby-Principles of Color and Color Mixing for 10 days' examination on approval. In 10 days I will send $4.50, plus few cents postage, or return book postpaid.
(Postage paid on cash orders)

Name .....
Address .....
City and State .....
Company .....
Position CE-11-47
(For Canadian price, write McGraw-Hill Co. of Canada Ltd., 12 Richmond Street E., Toronto 1)

For EFFICIENT Low-Temperature Drying . . .



Class "XC" RUGGLES-COLES DRYERS

The Class "XC" Ruggles-Coles Dryer, made by Hardinge, is a highly-efficient, indirect-heat, low-temperature steam dryer.

It is especially adaptable for drying materials that are injured by high-temperature—such as brewers' grain, cotton seed, starch feed, tobacco stems, corn germs, cannery wastes, and food products.

Basically, it is a rotary, cylindrical type dryer with steam pipes on the inside of the shell that rotate with it, and also serve as lifting flights.

For full details on this and the eight other types of Ruggles-Coles Dryers, write for Bulletin 16-C.

See the Hardinge Exhibit at the Chemical Industries Exposition Booth No. 60

HARDINGE
COMPANY INCORPORATED

YORK, PENNSYLVANIA — 240 Arch St. • Main Office and Works
NEW YORK 17—122 E. 42nd St. • 205 W. Wacker Drive—CHICAGO 6
SAN FRANCISCO 11—24 California St. • 200 Bay St.—TORONTO 1

EXHIBITORS
Classified by Products
CONTINUED

General American Transportation Corp. (285–287)
Grove Regulator Co. (640D)
Hoke, Inc. (213)
Lapp Insulator Co. Inc. (500–501)
Monarch Mfg. Works, Inc. (354)
Wright Austin Co. (461A)

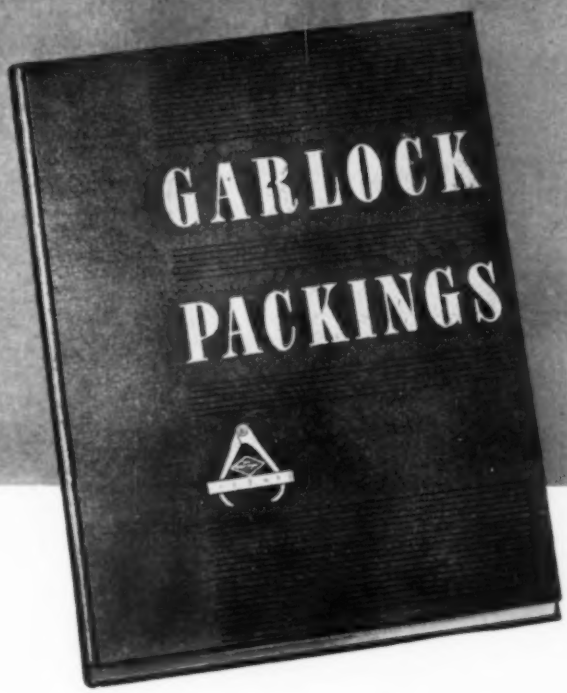
PUBLISHERS
Chemical Engineering (42)
Chemical Engineering Catalog (26–27)
Chemical & Engineering News (26–27)
Chemical Industries (28E and 28W)
Chemical Preview (506)
Food Industries (42)
Food Preview (506)
Industrial & Engineering Chemistry (26–27)
Interscience Publishers, Inc. (467)
McGraw-Hill Book Co. (283)
Materials & Methods (26–27)
Metal Industries Catalog (26–27)
Progressive Architecture (26–27)
Putman Publishing Co. (506)
Reinhold Publishing Co. (26–27)
Van Nostrand Co. Inc., D. (85)

PULVERIZERS
Allis-Chalmers Mfg. Co. (48–49)
Bartlett & Snow Co., C. O. (427–428)
Blaw Knox Div. of Blaw-Knox Co. (13–14)
Combustion Engrg. Co. Inc. Raymond Pulverizing Div. (67)
Denver Equipment Co. (507)
Eimer & Amend (57)
Fisher Scientific Co. (57)
Fitzpatrick Co., The W. J. (401–402)
Great Western Mfg. Co. (372–374)
Hardinge Co. Inc. (60)
Jay Bee Sales Co. (370)
Jeffrey Mfg. Co. (44A–45)
Pulverizing Machinery Co. (300–302)
Sprout, Waldron & Co. (550 to 552)
Sturtevant Mill Co. (3)
Will Corp. (667–668)
Williams Patent Crusher & Pulv. Co. (295)

PUMPS
Allis-Chalmers Mfg. Co. (48-49) centrifugal
Alsop Engineering Corp. (293) centrifugal
American Hard Rubber Co. (303–305) hard rubber and hard rubber lined
American Instrument Co. (385–387)
American Meter Co. (39–41) service
Ampco Metal Inc. (268) bronze
Denver Equipment Co. (507) centrifugal, diaphragm
Distillation Products, Inc. (625–626) high vacuum oil diffusion
Duriron Co. Inc., The (19–20) centrifugal, corrosion resisting
Eastern Industries, Inc. (220 to 224) industrial
Eco Engineering Co. (641) stainless steel and bronze
Eimco Corp. (605–606)
Eimer & Amend (57) laboratory
Fisher Scientific Co. (57)
Fuller Co. (315–317) vacuum
General Ceramics & Steatite Corp. (2) centrifugal
Hasco Valve & Machine Co. (569) sulfur
Haveg Corp. (51)
Hills-McCanna Co. (346) proportioning & metering

(*Continued on page* 370)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.



NEW GARLOCK CATALOG

Helps you select The Right Packing

IF YOU BUY or use packings or gaskets you need this new Garlock catalog.

Its 224 pages describe and illustrate packings for high pressures and low pressures—for water, air, steam, acids, solvents, oils and other liquids and gases. So whether you need a packing made of rubber, synthetic rubber, asbestos, cotton, flax, rayon, leather, plastics or metals, this catalog will help you select a Garlock product suitable for your job—a product manufactured in the Garlock factories and measuring up to the highest quality standards which Garlock has rigidly maintained for sixty years.

Ask the Garlock representative for your copy or mail the coupon below.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Limited, Montreal, Que.

Mail This Coupon!
FOR YOUR COPY

..... 1947

THE GARLOCK PACKING COMPANY
Palmyra, New York
Please send me a copy of the new Garlock catalog.

Name .....

Company ..... Zone ..... State CE-11

City .....

ALBERENE FUME HOODS

can be specially designed to reduce the possibility of

PERCHLORIC ACID EXPLOSIONS

Alberene Stone Corporation Engineers have made studies of explosions which have occurred in fume hoods where perchloric acid has been used. As a result of these studies we are now in a position to offer certain constructive suggestions with regard to the alteration of existing hoods or the design of new hoods which we believe will have the effect of greatly reducing the possibility of such explosions. We are also in a position to promptly contract for the execution of this work.

If you have such a hazard write to Alberene Stone Corporation of Virginia, 419—Fourth Avenue, New York 16, N. Y. or consult our nearest branch office Your inquiry will receive prompt attention

ALBERENE STONE
LABORATORY EQUIPMENT

BOWEN LABORATORY SPRAY DRYER

...for developing new products and processes

● The Bowen Laboratory unit is designed to provide information which can be directly applied to the development of new products and processes. It is built under the same general designs as the large commercial Bowen engineered Spray Dryers. Factual information on request.

BOWEN ENGINEERING, INC.
Garwood 1, New Jersey

BOWEN

BOOTH 493-495

EXHIBITORS
Classified by Products
CONTINUED

Industrial Steels, Inc. (650) stainless steel
Ingersoll-Rand Co. (615–617) centrifugal, etc.
Jabasco Pump Co. (678) rotary, corrosion resistent, self-priming
Kinney Mfg. Co. (468–469)
LaBour Co. Inc., The (32) centrifugal
Lapp Insulator Co. Inc. (500–501) centrifugal & proportioning
Lawrence Machine & Pump Corp. (663) centrifugal
Lead Lined Iron Pipe Co. (23) centrifugal, lead
Luzerne Rubber Co. (528–529) hard rubber
Marco Co. Inc. (646–647) rotary
Marlo Pumps (431) self-priming centrifugal, plunger, diaphragm
Nash Engineering Co. (16) vacuum, clean air, gas, condensation, acid, return line heating, non-lubricated, non-pulsating, laboratory
National Carbon Co. Inc. (30–31) Karbate
National Lead Co. (247) acid
National Research Corp. (472–473) diffusion
New Jersey Machine Corp. (485–486)
Oliver United Filters, Inc. (65–66) Olivete, acid handling
% Proportioneers, Inc. % (477–478) chemical & proportioning
Republic Filters, Inc. (556–557) filter
Robbins & Myers, Inc. (639–640)
Rodgers Co. Inc., George G. (679) centrifugal
Roy Co., Milton (432–433) acid, chemical, controlled volume, high pressure, food, proportioning, automatic controlled
Scientific Glass Apparatus Co. Inc. (215 to 219) laboratory
Schutte & Koerting Co. (291) rotary
Shriver & Co. Inc., T. (12) diaphragm
Stokes Machine Co., F. J. (80) vacuum
Syntron Co. (311–313) screw
Tri-Clover Machine Co. (567–568) sanitary, centrifugal
United States Stoneware Co. (89 to 91) acid
Welch Scientific Co., W. M. (405) vacuum
Will Corp. (667–668) laboratory
Worthington Pump & Machy. Corp. (319–321)

PYROMETERS

Bailey Meter Co. (274–276)
Cambridge Instrument Co. Inc. (330–332)
Eimer & Amend (57)
Electric Hotpack Co. Inc., The (655–656)
Engelhard, Inc., Charles (455)
Fischer Scientific Co. (57)
Illinois Testing Laboratories (38)
Norton Co. (415–416)
Rubicon Co. (380)
Scientific Glass Apparatus Co. Inc. (215 to 219)
Will Corp. (667–668)

RAW MATERIAL

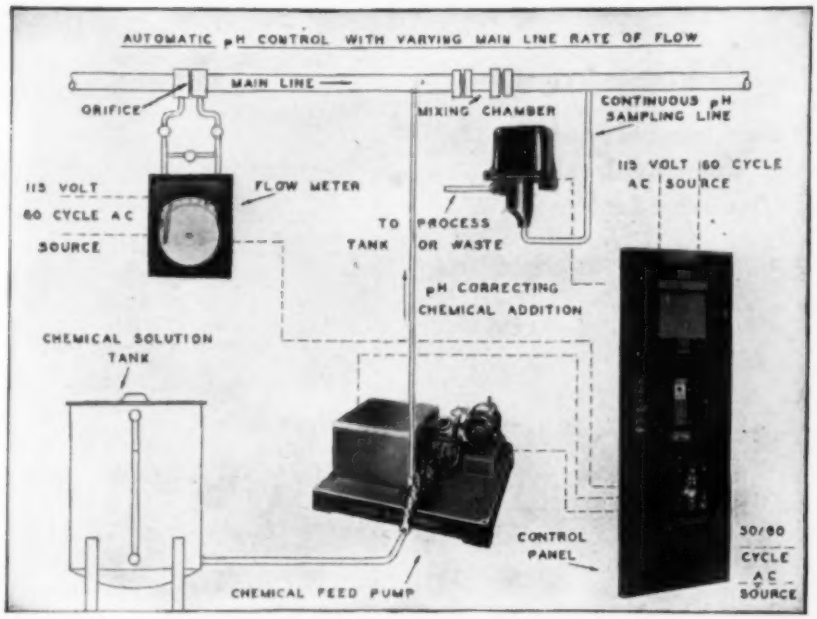
Davidson Chemical Corp., The (622–624)
Petroleum Specialties, Inc. (471)
Sharples Chemicals, Inc. (25–25A)
Sonneborn Sons, Inc. (471)
Titanium Alloy Mfg. Co. Inc. (366–368) metallurgical chemical

(*Continued on page* 372)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

21st EXPOSITION CHEMICAL INDUSTRIES — BOOTH 432-433

See *Automatic* Chemical Feed Systems in Operation *at* GRAND CENTRAL PALACE



Visit with us in Booths 432-433, Exposition of Chemical Industries, Grand Central Palace, New York City, Dec. 1 to 6,

and see . . .

- Automatic control of pH, conductivity and other processing variables demonstrated.
- Milton Roy Pumps in action.
- What's new in controlled volume metering units.
- The latest developments in Automatic Chemical Feed Systems.
- And a most interesting new development . . . a Milton Roy Pump that delivers a *constant flow, without pulsation,* in desired volumes as low as 25 cc. per hour.

Milton Roy Chemical Feed Systems are used for many processing applications. For boiler feed water treatment these systems add corrective chemicals without introducing excess solids at low loads or danger of under treatment at peak loads. For municipal water supply automatic chemical feed proportional to flow is an ideal control system . . . quickly amortizes its cost in preventing waste of expensive chemicals. Automatic pH control, as illustrated above, is a recognized necessity in many fields, including water treating, pharmaceutical manufacture, paper making and chemical processing.

Milton Roy Automatic Systems have wide application also in continuous chemical processing applications, assuring precise automatic control of the ratio of flow of two or more liquid streams to gas flow in cases where heretofore only batch operations were possible.

If you can't get to New York write for new catalog No. 461 and Technical Paper No. 54. "An Application of Electronics in Automatic Chemical Feed Systems." *Inquiries on specific applications are invited.*

MILTON Roy COMPANY

WITH THE EXCLUSIVE STEP-VALVE DESIGN

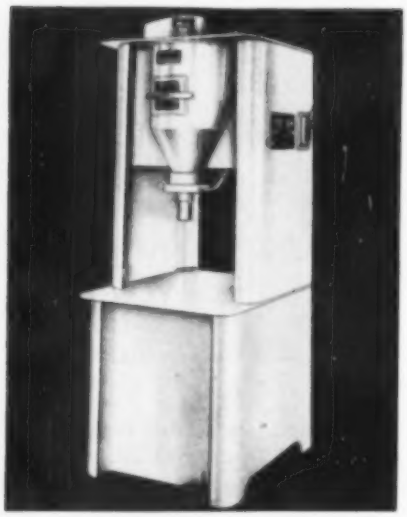
1322 E. Mermaid Ave., Chestnut Hill · Philadelphia 18, Pa.

See the

RODGERS PACKAGE FILLER

Demonstrated

At the Chemical Show, Booth 679
Grand Central Palace,
December 1st through 6th.



The new Rodgers Filler accurately fills all types of rigid and flexible containers with powder or paste. Low maintenance costs are assured due to advanced design and rugged construction. Send for our fully illustrated booklet for complete details on all new Rodgers equipment.

GEORGE G. RODGERS
Complete Line

STAINLESS STEEL TANKS
STAINLESS STEEL KETTLES
CHEMICAL PUMPS
BATCH MIXERS
CREAM FILLERS
PACKAGE FILLERS
TUBE CLOSERS AND CRIMPERS
PORTABLE MIXERS
CONVEYORS

SEND FOR BULLETINS

GEORGE G. RODGERS
COMPANY, INC.
225 West 34th St., New York 1, N. Y.
Tel: BR. 9-2040

EXHIBITORS • Classified by Products • CONTINUED

RAYON EQUIPMENT
American Hard Rubber Co. (303–305)
Andrew-Knapp Construction Co. Inc. (23)
Artisan Metal Products, Inc. (540–542)
Baker Perkins Inc. (62–63)
Hercules Filter Corp. (443–445) filters
Knapp Mills, Inc. (23)
Luzerne Rubber Co. (528–529)
Micro Metallic Corp. (671)
Republic Filters, Inc. (556–557) filters

RECORDING INSTRUMENTS
Bailey Meter Co. (274–276)
Builders-Providence, Inc. (479)
Cambridge Instrument Co. Inc. (330–332)
Distillation Products, Inc. (625–626)
Fischer & Porter Co. (203 to 207)
Industrial Instruments, Inc. (410)
Mine Safety Appliances Co. (376–378) carbon monoxide
Omega Machine Co. (480)
Photoswitch, Inc. (603)
Rubicon Co. (380)
Uehling Instrument Co. (356)

REFRACTORIES
Amersil Co. Inc. (454)
Bramley Machinery Corp. (524–525) mixers
Electro Chemical Supply & Engr. Co. (81)
Johns-Manville Corp. (93–94)
Munn & Steele, Inc. (406)
Norton Co. (415–416)
Scientific Glass Apparatus Co. Inc. (215 to 219)
Titanium Alloy Mfg. Co. (366–368)
United States Stoneware Co., The (89 to 91)
Will Corp. (667–668)

REFRIGERATING EQUIPMENT
Ingersoll-Rand Co. (615–617)
Luzerne Rubber Co. (528–529)
Niagara Blower Co. (233–235)
Pressed Steel Tank Co. (348 to 352)
Worthington Pump & Machinery Corp. (319–321)

REGULATORS—Pressure & Temperature
American Instrument Co. (385–387)
American Meter Co. (39–41)
Bailey Meter Co. (274–276)
Eclipse Fuel Engr. Co. (504)
Eimer & Amend (57)
Fischer & Porter Co. (203–207)
Fisher Scientific Co. (57)
Greiner Co., The Emil (226–228)
Grove Regulator Co. (640D)
Hoke, Inc. (213)
Kieley & Mueller, Inc. (643)
Leslie Co. (676)
Matheson Co., The (271)
Monarch Mfg. Works, Inc. (354)
Ohio Chemical & Mfg. Co., The (216)
Process & Instruments (518)
Sarco Co. Inc. (11)

RESPIRATORS
Martindale Electric Co. (440)
Hine Safety Appliances Co. (376–378)
Will Corp. (667–668)
Willson Products, Inc. (419–420)

RESINS & OILS
American Resinous Chemicals Corp. (35-36)
Atlas Powder Co. (46–47)
Darco Corp. (46–47)
Haveg Corp. (51)
Hercules Powder Co. Inc. W. Pt. (7)
Neville Co. (547–548)
Will Corp. (667–668)

ROTAMETERS
Fischer & Porter Co. (203 to 207)
Haveg Corp. (51)
Hoke, Inc. (213)
Jacoby-Tarbox Corp. (540–542)
Schutte & Koerting Co. (291)
Selas Corp. of America (533–534) floscopes

RUBBER PRODUCTS AND EQUIPMENT
American Tool & Machine Co. (412)
Bramley Machinery Corp. (524–525) mixers
Garlock Packing Co., The (244)
General Aniline & Film Corp. (619–620)
Heil Process Equip. Corp. (575)
Knight, Maurice A. (53)
Luzerne Rubber Co. (528–529)
PerfeKtum Products Co. (209–211)
United States Stoneware Co. (89 to 91)
Will Corp. (667–668)

RUST PROOFING
Davison Chemical Corp., The (622–624)
Lukens Steel Co. By-Products Steel Corp. Div. (558 to 563)
Magna Mfg. Co. Inc. (609)
Sharles Chemicals, Inc. (25–25A)
Socony-Vacuum Oil Co. Inc. (324–326)
Sonneborn Sons, Inc., L. (471)
United States Stoneware Co., The (89 to 91)
Wallace & Tiernan Products, Inc. (520–521)

SAFETY EQUIPMENT
Ampco Metal, Inc. (268)
Black, Sivalls & Bryson, Inc. (496)
Eriez Mfg. Co. (631) magnetic
Falstrom Co. (510–511) barrel lift
Mine Safety Appliance Co. (376–378)
Photoswitch, Inc. (603)
Scientific Glass Apparatus Co. Inc. (215 to 219)
Willson Products, Inc. (419–420)
Wright Austin Co. (461A) boiler gauge glass protection

SCALES
Builders-Providence, Inc. (479) conveying
Eimer & Amend (57)
Exact Weight Scale Co. (476)
Fisher Scientific Co. (57)
Glengarry Machine Works, Inc. (659–660)
Gump Co., B. F. (362–364)
% Proportioneers, Inc. % (477–478)
Scientific Glass Apparatus Co. Inc. (215 to 219)
Toledo Scale Co. (44B)
Welch Scientific Co., W. M. (405)
Will Corp. (667–668)
Yale & Towne Mfg. Co., The (278)

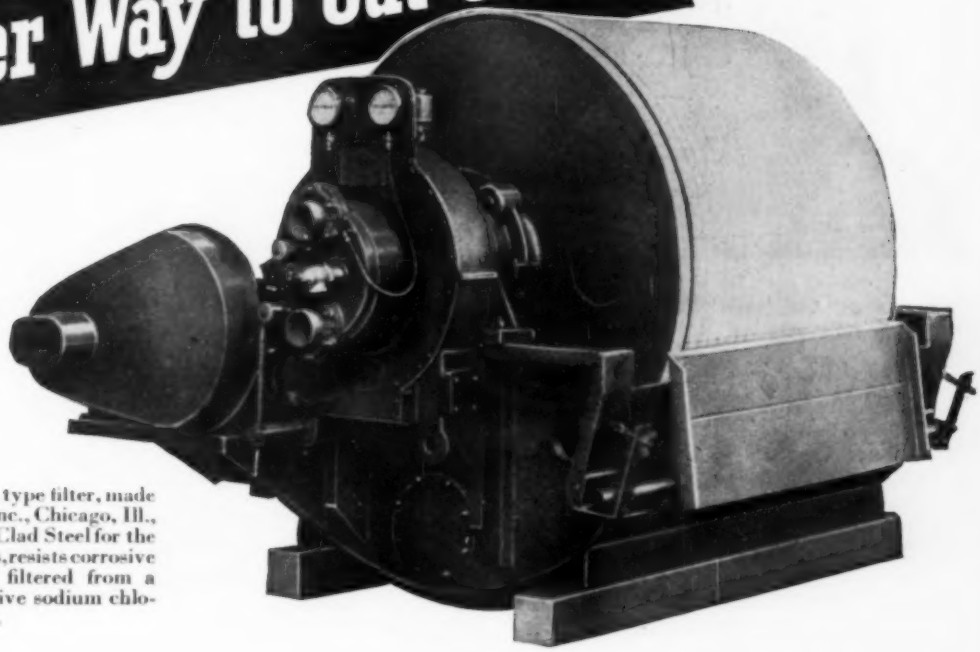
SCREENS—Inclined, Vibrating, Gyratory
Allis-Chalmers Mfg. Co. (48–49)
Denver Equipment Co. (507)
Great Western Mfg. Co. (372–374)
Gump Co., B. F. (362–364)
Jeffrey Mfg. Co. (44A–45)
Productive Equipment Corp. (549)

(*Continued on page* 374)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

No Guesswork about Protection...

No Easier Way to Cut Costs



Continuous vacuum drum type filter, made by Oliver United Filters, Inc., Chicago, Ill., using 20% Lukens Nickel-Clad Steel for the drum heads and filter tanks, resists corrosive attack by slurries being filtered from a solution containing corrosive sodium chloride and calcium chloride.

You can save as much as 50 per cent on material costs with Lukens Clad Steels—and still provide "solid" protection against corrosion and contamination. Positive control over the uniformity of cladding thickness gives you the *exact* protection your equipment and products require. There's *no guesswork* about it! And you can specify the cladding best suited for your problem . . . nickel, Inconel, Monel or any standard type of stainless.

Lukens precision method of cladding cuts costs in other ways, too. The bond between cladding metal and ASME quality steel backing is *permanent*. Commercial methods for bending, shearing, pressing or welding are employed.

For *extra* savings choose the widest plate you can use. Shortens fabrication time . . . cuts welding footage costs. Lukens Clad Steels are available in plates up to 178" wide, or from 3/16" to over 3" thick.

Information on money-saving Lukens Stainless-Clad Steels is contained in Bulletin 338; on Nickel-Clad, Inconel-Clad and Monel-Clad Steels, in Bulletin 255. For your copies, write Lukens Steel Company, 400 Lukens Building, Coatesville, Pa.

CLAD METAL STEEL

★ ★ ★

Be sure to see us at Booth Nos. 558-563 at the Chemical Show, New York City, December 1-6. Find out how you can get solid metal advantages with clad steel economy.

LUKENS

Nickel-Clad Stainless-Clad
Inconel-Clad Monel-Clad
STEELS

★

SOLID METAL ADVANTAGES WITH CLAD STEEL ECONOMY

Sutton, Steele & Steele

AIR TABLES

are more sensitive concentrators than any other type of gravity separators

You cannot use wet tables or use flotation reagents on half-inch particles . . .

You CAN use AIR TABLES.

You cannot separate by wet tables or flotation reagents round from flat particles . . .

You CAN with AIR TABLES.

You can't treat 5 to 8 tons per hour on a single unit of wet table or flotation cell . . .

You CAN with an AIR TABLE.

COME TO BOOTH 52 at the CHEMICAL SHOW

and find out what others are doing with AIR TABLES.

Our engineers will be glad to help solve your separating or concentrating problems and submit recommendations. Send sample for laboratory tests.

SUTTON, STEELE & STEELE, INC.
DALLAS, TEXAS
SALES OFFICES
Separations Engineering Corporation
110 EAST 42nd STREET, NEW YORK, N. Y.
OLIVER BUILDING, PITTSBURGH, PENNSYLVANIA
ENGINEERING BUILDING, CHICAGO, ILLINOIS
FLOUR EXCHANGE BUILDING
MINNEAPOLIS, MINNESOTA
41-43 DRUMM STREET
SAN FRANCISCO, CALIFORNIA
S S & S
THE PROCESS FOR BETTER PRODUCTS-FASTER

EXHIBITORS • Classified by Products • CONTINUED

Read Machinery Div. of Standard Stoker Co. (280)
Richmond Mfg. Co. (519)
Separations Engineering Corp. (52) electrostatic
Simplicity Engineering Co. (601A) watering
Sprout, Waldron & Co. (550 to 553)
Syntron Co. (311-313)
Sturtevant Mill Co. (3)
Tyler Co., The W. S. (88)
Williams Patent Crusher & Pulverizer Co. (295)

SCREENS—Other

Allis-Chalmers Mfg. Co. (48–49)
Bartlett & Snow Co., C. O. (427–428) rotary
General American Transportation Corp. (285–287)
National Lead Co. (247) paper mill production
Newark Wire Cloth Co. (83–84)
Richmond Mfg. Co. (519)
Roebling's Sons, Inc., John A. (358–360) wire
Schutte & Koerting Co. (291)
Sprout, Waldron & Co. (550 to 553)
Stokes Machine Co., F. J. (80)
Tyler Co., The W. S. (88)
Will Corp. (667–668)

SEALING MACHINES

PerfeKtum Products Co. (209–211)
Triangle Package Machinery Co. (514)

SEPARATORS

American Tool & Machine Co. (412) centrifugal
Black, Sivalls & Bryson, Inc. (496) oil and gas
Combustion Engineering Co. Inc. Raymond Pulverizing Div. (67) mechanical and air
DeLaval Separator Co., The (323) industrial, centrifugal
Eriez Mfg. Co. (631) permanent non electric pulleys, drums, plates
Federal Classifier Systems, Inc. (404) air
Fletcher Works, Inc. (33) centrifugal
General American Transportation Corp. (285–287)
Great Western Mfg. Co. (372–374)
Hardinge Co. Inc. (60) grinding mills
Ritter Products Corp. (56) electrostatic
Selas Corp. of America (533–534) fluid and liquid
Separations Engineering Corp. (52) air tables
Sharples Co. The (58–59) centrifugal
Sprout, Waldron & Co. (550 to 553)
Sturtevant Mill Co. (3) (air)
Welding Engineers, Inc. (407–408) chemical industry
Williams Patent Crusher & Pulverizer Co. (295) air
Wright Austin Co. (461) air, gas, oil, steam

SHEET METAL WORK

Allegheny Ludlum Steel Corp. (250 to 254) stainless
Black, Sivalls & Bryson, Inc. (496)
Falstrom Co. (510–511)
Glengarry Machine Works, Inc. (659–660)
Heil Process Equipment Corp. (575)
Koven & Bro. Inc., L. O. (304–306)
Sprout, Waldron & Co. (550 to 553)
Makepeace Co., D. E. (453)

SIEVES—Laboratory

American Instrument Co., The (385–387)
Eimer & Amend (57)
Fisher Scientific Co. (57)
Great Western Mfg. Co. (372–374)
Richmond Mfg. Co. (519)
Newark Wire Cloth Co. (83–84)
Scientific Glass Apparatus Co. Inc. (215 to 219)
Standard Scientific Supply Corp. (618)
Tyler Co., The W. S. (88)
Welch Scientific Co., W. M. (405)
Will Corp. (667–668)

SIFTERS

Allis-Chalmers Mfg. Co. (48–49)
American Instrument Co., The (385–387)
Great Western Mfg. Co. (372–374)
Gump Co., B. F. (362–364)
Read Machinery Div. of Standard Stoker Co. (280)
Richmond Mfg. Co. (519)
Simplicity Engr. Co. (601A)
Sprout Waldron & Co. (550 to 553)
Tyler Co., The W. S. (88)
Will Corp. (667–668)

SILICA

Dicalite Co., The (86–87)
Johns-Manville Corp. (93–94)
Socony-Vacuum Oil Co. Inc. (324–326)
Will Corp. (667–668)

SINKS—Laboratory, Acid Proof

Alberene Stone Corp. of Virginia (79)
Andrews-Knapp Constr. Co. Inc. (23)
Blickman, Inc., S. (474–475)
Eimer & Amend (57)
Fisher Scientific Co. (57)
General Ceramics & Steatite Corp. (2)
Haveg Corp. (51)
Industrial Steels, Inc. (650) stainless steel
Kewaunee Mfg. Co. (44A–45)
Knapp Mills, Inc. (23)
Knight, Maurice A. (53)
Luzerne Rubber Co. (528–529)
Metalab Equipment Corp. (462–464)
Sheldon & Co., E. H. (255)
Sjostrom Co., John E. (664)
United States Stoneware Co. (89 to 91)
Welch Scientific Co., W. M. (405)
Wright-Austin Co. (461A)

SIZERS

Allis-Chalmers Mfg. Co. (48–49)
Denver Equipment Co. (507) classifiers, screens
Dorr Company (64–65)
General American Transportation Corp. (285–287)
Productive Equipment Corp. (549)
Ritter Products Corp. (56)

SOLVENT RECOVERY EQUIPMENT

Allis-Chalmers Mfg. Co. (48–49)
Artisan Metal Products Inc. (540–542)
Blaw-Knox Div. of Blaw-Knox Co. (13–14)
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Carbide & Carbon Chemicals Corp. (17–18)
Industrial Process Engineers (441)
Koven & Bro. Inc., L. O. (304–306)
Republic Filters, Inc. (556–557)

(*Continued on page 376*)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

MEET GLYCO'S CHEMISTS

AT THE

EXPOSITION OF CHEMICAL INDUSTRIES

GRAND CENTRAL PALACE, NEW YORK CITY

DECEMBER 1-6, 1947

Come to Booths 225-227

See our new products; discuss new applications. We will have on display chemicals of interest for: Adhesives, Chemical Intermediates, Coatings, Cosmetics, Foods, Metals, Oils, Paper, Plastics, Polishes, Rubber, Textiles.

CHEMICALS BY GLYCO

Chlorinated Products

Polyhydric Alcohol Esters

Plasticizers

Emulsifiers

Lubricants

Synthetic Waxes

Wetting Agents

Flameproofing Agents

Defoaming Agents

A number of our chemists will be on hand to help you with your technical problems.

If you can't attend the show, send for our 1947 Catalogue, "Chemicals by Glyco." You will find many new ideas, formulae and complete information on a wide selection of synthetic materials.

GLYCO PRODUCTS CO., Inc.

26 COURT STREET, BROOKLYN 2, N. Y.

STOP MOISTURE DAMAGE TO COMPRESSED AIR TOOLS AND PROCESSES

● For the driest possible compressed air or gas, use the Niagara Aero After Cooler. Reducing the temperature of the compressed air below that of the air surrounding your lines and tools, it prevents condensation in them and saves trouble and expensive repairs and frequent replacement of air tools. It produces compressed air with 30% to 50% less moisture than by ordinary cooling methods. In addition, it saves the cost of cooling water, paying for itself in a short time.

If you use compressed air for operating tools or for any process that brings it in contact with your product, the Niagara Aero After Cooler will decrease your costs and prevent damage.

Write for Bulletins 96-CM and 98-CM.

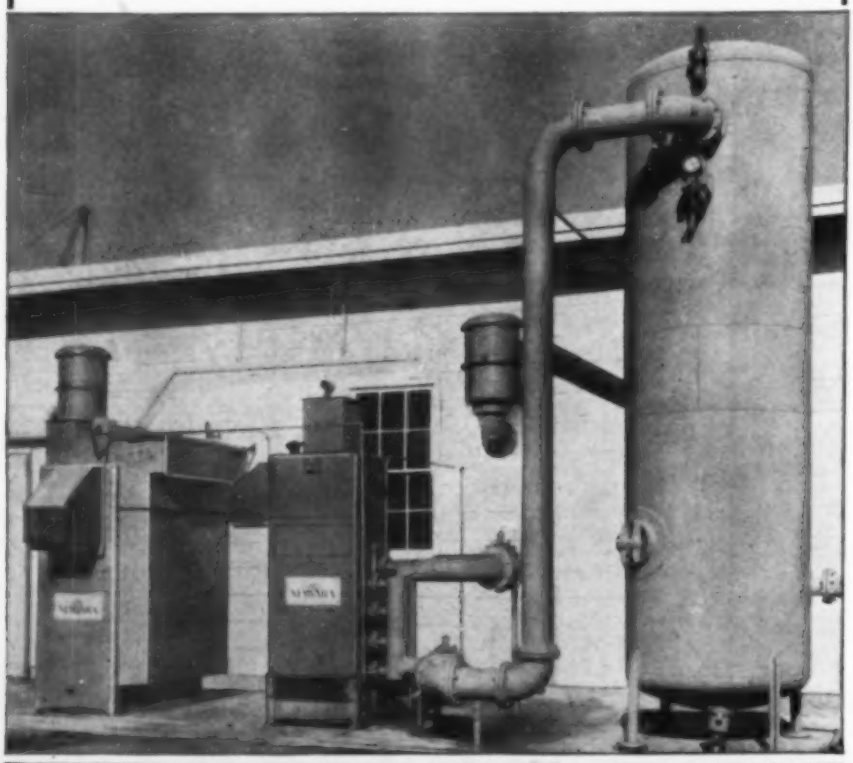
See Exhibit Booths 233-234-235

CHEMICAL INDUSTRIES EXHIBITION

Grand Central Palace

NIAGARA BLOWER COMPANY

405 Lexington Ave. New York 17, N. Y.



INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

EXHIBITORS
Classified by Products
CONTINUED

Selas Corp. of America (533–534)
Stokes Machine Co., F. J. (80)
Technicon Co., The (640B)
Will Corp. (667–668)

SOLVENTS

Ansul Chemical Co. (82) sulfur dioxide, methyl chloride
Carbide & Carbon Chemicals Corp. (17–18)
Coleman Instruments Inc. (381 and A) spectrophotomer
Eimer & Amend (57)
Fisher Scientific Co. (57)
Glyco Products Co. Inc. (225–227)
Koppers Co. Inc. (264)
Neville Co. (547–548)
Sharples Chemicals, Inc. (25 and 25A)
Socony-Vacuum Oil Co. Inc. (324–326)

SPECTROGRAPHIC EQUIPMENT

Baird Associates, Inc. (610)
National Technical Laboratories (265 to 269)
Standard Scientific Supply Corp. (618)

SPEED REDUCERS

Allis-Chalmers Mfg. Co. (48–49)
Cleveland Worm & Gear Co., The (502–503) worm gear
Mixing Equipment Co. Inc. (307–309, 334–336)
Philadelphia Gear Works, Inc. (78)
Reeves Pulley Co. of N. Y. Inc. (34)
Worthington Pump & Machinery Corp. (319–321)

SPRAY DRYING SYSTEMS

Bowen Engineering, Inc. (493–495)
Glengarry Machine Works, Inc. (659–660)

STAIR STEPS—SAFETY

Blaw-Knox Div. of Blaw-Knox Co. (13–14)
Lukens Steel Co. By-Products Steel Corp. (558 to 563)
Norton Co. (415–416)

STEEL GRATING & FLOORING

Blaw-Knox Div. of Blaw-Knox Co. (13–14)
United States Steel Corp. (76–77)

STEEL

Allegheny-Ludlum Steel Corp. (250 to 254) stainless wire

STERILIZERS

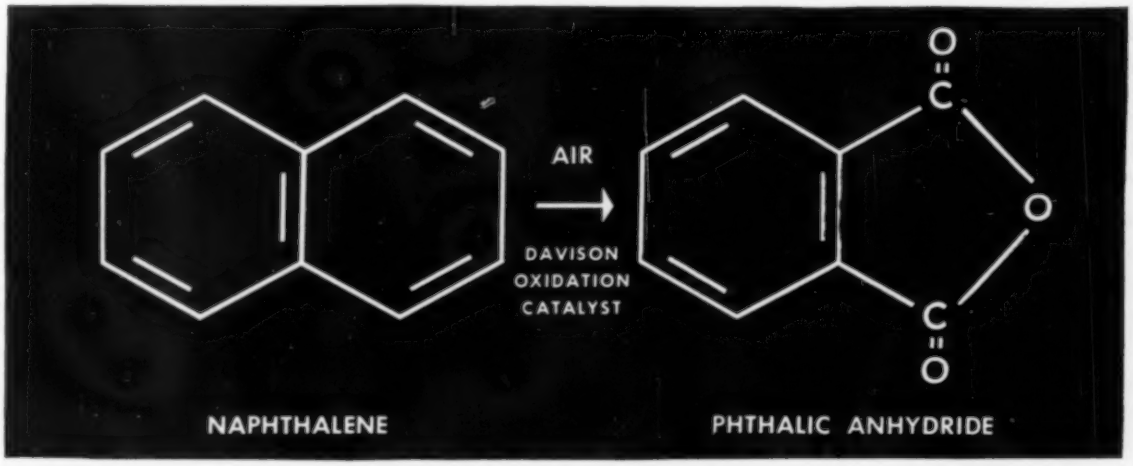
Aetna Scientific Co. (218)
American Instrument Co. (385–387)
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Eimer & Amend (57)
Electric Hotpack Co. Inc., The (655–656)
Fisher Scientific Co. (57)
Ohio Chemical & Mfg. Co., The (216) laboratory
PerfeKtum Products Co. (209–211)
Scientific Glass Apparatus Co. Inc. (215 to 219)
Standard Scientific Supply Corp. (618)
Wallace & Tiernan Products Co. (520–521)
Welch Scientific Co., W. M. (405)
Will Corp. (667–668)

(*Continued on page* 378)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

Davison Announces...

a new Gel Type Catalyst for the oxidation of hydrocarbons



This new Davison Gel Type Catalyst is made for a specific purpose—the oxidation of hydrocarbons. It is being successfully used in the catalytic oxidation of naphthalene to phthalic anhydride. Other suggested uses for this Davison Oxidation Catalyst are: xylene → phthalic anhydride: benzene → maleic anhydride: phenol to cyclohexanol → adipic acid. The catalyst can be supplied in various mesh sizes.

This is another Davison Catalyst now available to the petroleum refining and chemical industries.

THE DAVISON CHEMICAL CORPORATION

Progress through Chemistry

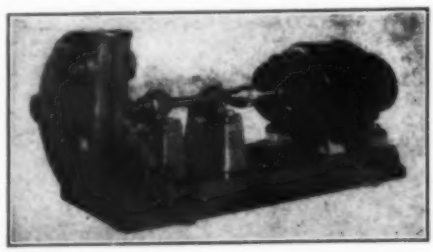
BALTIMORE 3, MARYLAND

PIONEERS . . . DEVELOPERS . . . AND PRODUCERS OF SILICA GEL

LAWRENCE CENTRIFUGAL PUMPS

Booth 663 — CHEMICAL SHOW

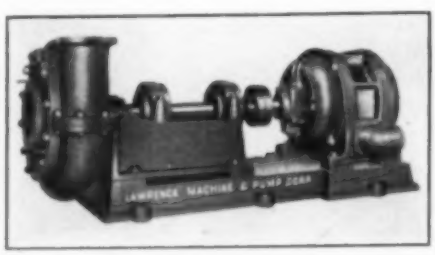
The three units here pictured—to be seen in our exhibit—are typical of the specialized study and design that LAWRENCE engineers have given to the problems of the chemical and process industries. There probably is not a fluid or semi-fluid—acid or alkaline, corrosive or abrasive or fibrous—in the pumping of which LAWRENCE CENTRIFUGALS are not showing outstanding performance. The comprehensive experience thus gained is available—without obligation—to all chemical and process engineers with difficult or unusual pumping problems. Let us work with you, in applying the LAWRENCE PUMP that will assure you THE LOWEST PUMPING COST PER UNIT OF MATERIAL HANDLED.



Above:—A steam-jacketed pump designed to handle heavy or viscous liquids that must be kept at high temperature in order to remain fluid.

At Left:—A vertical top-suction pump for volatile liquids or sludges, or for pumping from vessels under high vacuum, such as evaporators.

Below:—A slurry pump with removable and renewable lining of special wear-resistant metal, designed for handling a highly abrasive crystal mixture.



LAWRENCE MACHINE & PUMP CORP.

369 Market Street LAWRENCE, MASS.

LAWRENCE CENTRIFUGALS FOR EVERY PUMPING DUTY

EXHIBITORS Classified by Products CONTINUED

STILLS

Aetna Scientific Co. (218) water
American Instrument Co., The (385-387)
Andrews-Knapp Construction Co. Inc. (23)
Artisan Metal Products Inc. (540–542)
Barnstead Still & Sterilizer Co. Inc. (229–231) water
Blickman, Inc., S. (464–475) stainless steel
Buflovak Equipment Div. of Blaw-Knox Co. (6)
Distillation Products, Inc. (625–626) molecular, high vacuum
Eimer & Amend (57)
Electric Hotpack Co. Inc., The (655-656) electric, water
Fischer Scientific Co. (57)
General Ceramics & Steatite Corp. (2)
Industrial Process Engineers (441)
Knapp Mills, Inc. (23)
Koven & Bro. Inc., L. O. (304–306) all kinds
National Research Corp. (472–473) vacuum
PerfeKtum Products Co. (209–211)
Pfaudler Co. The (72–73) glass lined stainless steel
Scientific Glass Apparatus Co. Inc. (215 to 219) laby. water
Standard Scientific Supply Corp. (618) laboratory
Stokes Machine Co., F. J. (80) water, solvents, vacuum
Welding Engineers, Inc. (407–408) for chemical industry
Will Corp. (667–668) laboratory

STRAINERS

Kieley & Mueller, Inc. (643)
Leslie Co. (676)
Luzerne Rubber Co. (528–529)
Monarch Mfg. Works, Inc. (354)
Newark Wire Cloth Co. (83–84)
Sarco Co. Inc. (11)
Schutte & Koerting Co. (291)
Wright Austin Co. (461A)

STRAPPING—Steel

Roebling's Sons, Inc. John A. (358-360)

SWITCHES

Fischer & Porter Co. (203 to 207)
Photoswitch, Inc. (603)

TACHOMETERS

Bailey Meter Co. (274–276)
Builders-Providence, Inc. (479)
Eimer & Amend (57)
Fisher Scientific Co. (57)
Reliance Electric & Engr. Co., The (674–675)
Welch Scientific Co., W. M. (405)
Weston Electrical Instrument Corp. (263)
Will Corp. (667–668)

TANKS

Alsop Engineering Corp. (293) stainless steel
American Hard Rubber Co. (303-305) rubber lined
Amersil Co. Inc. (454) fused silica
Andrews-Knapp Construction Co. Inc. (23) lead lined
Black, Sivalls & Bryson, Inc. (496) steel & wood)

(*Continued on page* 380)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

OXALATES

Ammonium Oxalate

Potassium Oxalate

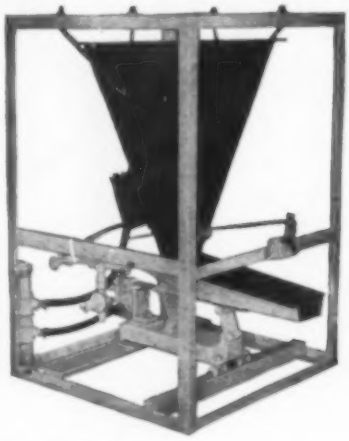
Iron Oxalate

Iron and Ammonium Oxalate

Iron and Sodium Oxalate

CHAS. PFIZER & CO., INC., 81 Maiden Lane, New York 7, N.Y.
444 West Grand Avenue, Chicago 10, Ill.
605 Third Street, San Francisco 7, Cal.

PFIZER *Manufacturing Chemists Since 1849*



Efficient Material Handling with

SYNTRON

HYDRAULIC VIBRATION

"Hydra-Pulse"
VIBRATORS
For "FREE-FLOWING" bins, hoppers and chutes.

"Hydra-Flow"
VIBRATING FEEDERS
For "CONTROLLED FEEDING" of bulk materials.

"Hydra-Flow"
VIBRATING FEEDER MACHINES
Complete units, with vibrated supply hopper and vibrating feeder, as illustrated above.

WATER—AIR—OR OIL OPERATED to suit the application. EXPLOSION PROOF for use in hazardous atmospheric locations or handling explosive materials.

SYNTRON CO., 610 Lexington, Homer City, Pa.

FOR *Better*

HOMOGENIZING
EMULSIFYING
GRINDING

When you examine the unique design of an EPPENBACH COLLOID MILL, it is easy to understand why finer diffusion is obtained with this machine. Liquid is broken up into minute globules by high velocity impact . . . rotor and stator teeth shear the material mechanically . . . then it is hydraulically sheared to the required particle size.

If you are interested in obtaining better results in grinding, emulsifying and homogenizing, write for complete details. Ask for a copy of Catalog No. 401. No obligation of course.

EPPENBACH INC.
Processing Equipment for Over 30 Years
44-02 11th Street Long Island City 1, N. Y.

BOOTH 289

EXHIBITORS
Classified by Products
CONTINUED

Blickman, Inc. S. (474–475) stainless steel
Denver Equipment Co. (507) steel, wood
Electro Chemical Supply & Engr. Co. (81) brick lined
Eppenbach, Inc. (289)
Falstrom Co. (510–511) open, non-pressure
General American Transportation Corp. (285–287)
General Ceramics & Steatite Corp. (2) stoneware
Glascote Products, Inc. (657–658) glass lined
Haveg Corp. (51)
Heil Process Equipment Corp. (575) processing
Knapp Mills, Inc. (23) lead lined
Knight, Maurice A. (53) acid proof
Koven & Bro. Inc., L. O. (304–306) all kinds
Luzerne Rubber Co. (528–529) hard rubber
Metal-Glass Products Co. (425–426) stainless steel
National Lead Co. (247) lead lined
New England Tank & Tower Co. (50)
Pfaudler Co., The (72–73) glass lined, stainless steel
Pressed Steel Tank Co. (348 to 352) steel
Rodgers Co. Inc., George C. (679) stainless steel
Trent, Inc. (526–527) calibrating
United States Stoneware Co. The (89 to 91)
Welding Engineers, Inc. (407–408)
Wright Austin Co. (461A) chemical

THERMOMETERS
American Meter Co. (39–41)
Bailey Meter Co. (274–276)
Cambridge Instrument Co. Inc. (330–332)
Eimer & Amend (57)
Electric Hotpack Co. Inc., The (655–656)
Fisher Scientific Co. (57)
Greiner Co., The Emil (226–228)
Kimble Glass Div. of Owens-Illinois Glass Co. (342–344) chemical
Sarco Co. Inc. (11)
Scientific Glass Apparatus Co. Inc. (215 to 219)
Standard Scientific Supply Corp. (618)
Welch Scientific Co., W. M. (405)
Weston Electrical Instrument Corp. (263)
Will Corp. (667–668)

THICKENING & DEWATERING MACHINERY
American Tool & Machine Co. (412)
Denver Equipment Co. (507)
Dorr Co., The (64–65)
Filtration Engineers, Inc. (8)
General American Transportation Corp. (285–287)
Hardinge Co. Inc. (60)
Productive Equipment Corp. (549)
Tolhurst Centrifugals Div. American Machine & Metals, Inc. (68–69)
Tyler Co., The W. S. (88)

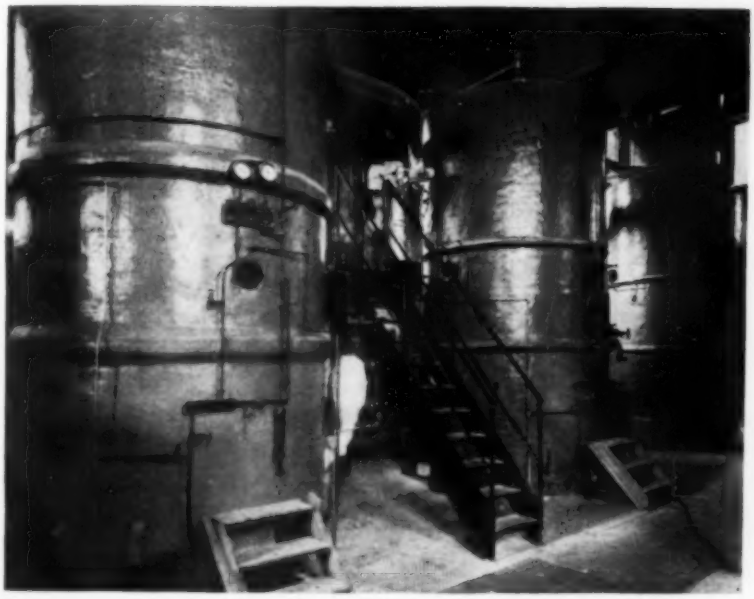
TOWER PACKING OR FILLING
Amersil Co. Inc. (454)
Electro Chemical Supply & Eng. Co. (81)
General Ceramics & Steatite Corp. (2)

(*Continued on page* 382)

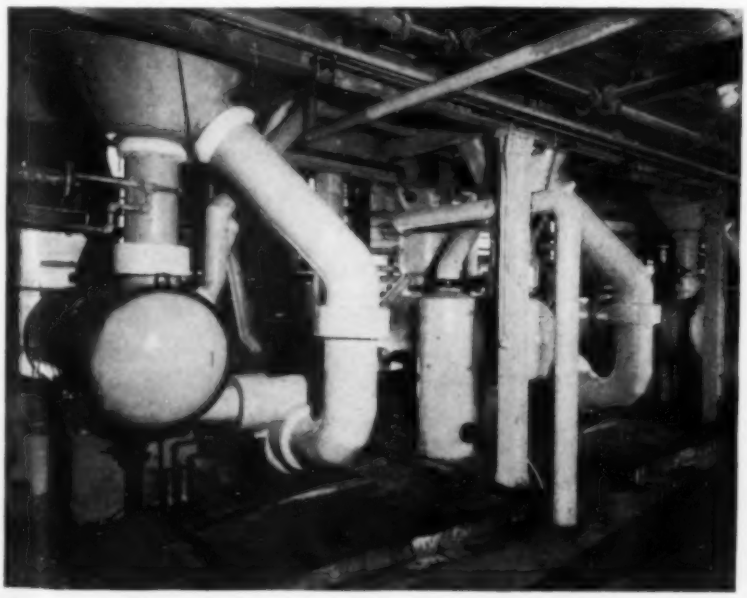
Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

Zaremba Company design brings caustic producer

3-way benefits { LONG EQUIPMENT LIFE / HIGH PRODUCT PURITY / DAILY 60-TON OUTPUT



OPERATING ON 70-POUND STEAM PRESSURE *with 27" vacuum in the third effect, these evaporators of Lukens Nickel-Clad Steel at the Niagara Alkali Co. have nickel tubes and tube sheets. Corrosion resistance, long life and good heat transfer properties are thus assured. (Equipment designed by Zaremba Company, Buffalo, N. Y.)*



BENEATH THE OPERATING FLOOR: *This view shows steam chest circulating pumps and piping of the triple effect evaporator pictured above. Pump casings and impellers are solid nickel. Each pump circulates 3,000 gpm through the tubes and back into the vapor body.*

You're looking at a triple effect forced circulation evaporator that's five years old.

It produces 50 per cent sodium hydroxide of high purity at the rate of 60 tons daily.

ZAREMBA COMPANY, Buffalo, N. Y., specialists in the design of caustic-handling equipment, ***specified long-lasting solid nickel and economical Lukens Nickel-Clad Steel for construction.***

Possessing excellent resistance to dilute or concentrated caustic at all usual operating temperatures, nickel permits continuous production of high purity caustic.

Good Heat Transfer

Where rapid heat transfer is required, nickel is superior to other materials having comparable strength and corrosion resistance.

For the vapor bodies, Lukens Nickel-Clad Steel (which consists of a relatively thin layer of pure nickel permanently bonded to a much thicker sheet of steel) provides the corrosion-resistant, non-contaminating properties of nickel—*at considerably lower cost.*

Suitable for Many Jobs

Even though you may not manufacture caustic soda, there are countless places where you can use nickel with the strength of steel for processing and handling caustics, ethyl cellulose, phenol, plastics and other synthetics, intermediates, reagents and solvents.

Be sure to consider both nickel and Lukens Nickel-Clad Steel when you seek ways to balk corrosion, guard product purity, lengthen equipment life or reduce maintenance costs.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 WALL STREET, NEW YORK 5, N. Y.

INCO TRADE MARK **Nickel** ...for long, trouble-free life

The Engelhard

CO_2 Analyzer

For checking CO_2 and flue gas temperature, the ENGELHARD FLUALIZER combines a thermocouple with a thermal conductivity cell, in a rugged, portable unit. Complete with aspirator bulb, a dryer, hose and all accessories. Weight only 8 lbs.

Write for Bulletin 700

Charles Engelhard Inc.

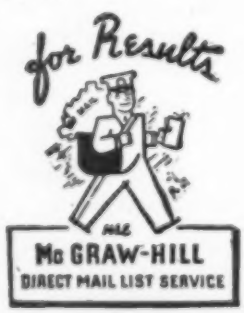
900 Passaic Ave., East Newark, N. J.

Solves the Problem of Mailing List Maintenance!

Probably no other organization is as well equipped as McGraw-Hill to solve the complicated problem of list maintenance during this period of unparalleled change in industrial personnel.

McGraw-Hill Mailing Lists cover most major industries. They are compiled from exclusive sources, and are based on hundreds of thousands of mail questionnaires and the reports of a nation-wide field staff. All names are guaranteed accurate within 2%.

When planning your direct mail advertising and sales promotion, consider this unique and economical service in relation to your product. Details on request.



McGraw-Hill Publishing Co., Inc.
DIRECT MAIL DIVISION
330 West 42nd St., New York, 18, N. Y.

BOOTH 42

EXHIBITORS • Classified by Products • CONTINUED

Haveg Corp. (51)
Knight, Maurice A. (81)
Lapp Insulator Co. Inc. (500–501)
National Carbon Co. Inc. (30–31)
Scientific Glass Apparatus Co. Inc. (215 to 219)
United States Stoneware Co. (89 to 91)

TOWERS

American Hard Rubber Co. (303–305) rubber lined
Andrews-Knapp Construction Co. Inc. (23)
Artisan Metal Products, Inc. (540–542)
Black, Sivalls & Bryson, Inc. (496)
Durion Co. Inc., The (19–20)
Electro Chemical Supply & Engr. Co. (81)
General American Transportation Corp. (285–287)
General Ceramics & Steatite Corp (2)
Haveg Corp. (51)
Industrial Process Engineers (441)
Knapp Mills, Inc. (23)
Knight, Maurice A. (53)
National Carbon Co. Inc. (30–31)
United States Stoneware Co. The (89–to 91)

TRANSMISSION EQUIPMENT

Allis-Chalmers Mfg. Co. (48–49)
Baldwin Belting, Inc. (662)
Fischer & Porter Co. (203 to 207)
General Electric Co. (4)
Great Western Mfg. Co. (372–374)
Reeves Pulley Co. of N. Y., Inc. (34)
Reliance Electric & Engr. Co. (674–675)
Sprout, Waldron & Co. (550 to 553)
Worthington Pump & Machinery Corp. (319–321)

TUBES

Allegheny-Ludlum Steel Corp. (250 to 254 (stainless)
Amersil Co., Inc. (454) fused silica
Builders-Providence, Inc. (479) venturi
Carpenter Steel Co. Alloy Tube Div. (491–492) stainless, heat exchanger
Fischer & Porter Co. (203 to 207) glass
Globe Steel Tubes Co. (537–538) glo-weld, globeiron
Haveg Corp. (51)
Industrial Steels, Inc. (650) stainless
International Nickel Co. (9–10) nickel and alloys
Kimble Glass Div. of Owens-Illinois Glass Co. (342–344) test & culture
Norton Co. (415–416) refractory, porous
Process & Instruments (518) mass spectrometer
Republic Steel Corp. (434–436) stainless steel
Titeflex, Inc. (281) all-metal, flexible
Trent Tube Mfg. Co. (644–645) stainless steel, inconel
U. S. Stoneware Co., The (89 to 91) plastic

ULTRA VIOLET LAMPS

Denver Equipment Co. (507) minerlight
Eimer & Amend (57)
Fischer Scientific Co. (57)
Gamma Scientific Co. (497)
Hanovia Chemical & Mfg. Co. (457–458)
National Technical Laboratories (265 to 269)
Will Corp. (667–668)

VALVES and FITTINGS

Alloy Steel Products Co. (669–670)
American Hard Rubber Co. (303–305)
American Instrument Co., The (385–387)
American Meter Co. (39–41)
Ampco Metal, Inc. (268)
Andrews-Knapp Construction Co., Inc. (23)
Black, Sivalls & Bryson, Inc. (496)
Cooper Alloy Foundry Co., The (565–566) stainless steel
Crane Co. (297)
Distillation Products, Inc. (625–626) high vacuum
Duriron Co., Inc., The (19–20)
Fischer & Porter Co. (203 to 207)
General Ceramics & Steatite Corp. (2)
General Alloys Co. (299)
Grinnell Co., Inc. (251)
Grove Regulator Co. (640D)
Hasco Valve & Machine Co. (569)
Haveg Corp. (51)
Hoke, Inc. (213)
Illinois Electric Porcelain Co. (672–673)
Industrial Steels, Inc. (650) stainless steel
Jacoby-Tarbox Corp. (540–542) stainless steel
Jerguson Gage & Valve Co. (564)
Kieley & Mueller, Inc. (468–469)
Knapp Mills, Inc. (23)
Knight, Maurice A. (53)
Lapp Insulator Co., Inc. (500–501)
Lead Lined Iron Pipe Co. (23)
Luzerne Rubber Co. (528–529)
National Carbon Co., Inc. (30–31)
National Lead Co. (247) lead
National Research Corp. (472–473) vacuum
Nordstrom Valve Div. Rockwell Mfg. Co. (61)
Parker Appliance Co., The (21)
Pfaudler Co., The (72–73) glass lined
Powell Co., The Wm. (54)
Schutte & Koerting Co. (291)
U. S. Stoneware Co. (89 to 91)
Walworth Co. (316–318)
Worthington Pump & Machinery Corp. (319–321)

VENTILATING APPARATUS

Haveg Corp. (51)
Knight, Maurice A. (53)
Metalab Equipment Corp. (462–464) laboratory

VIBRATORS

Great Western Mfg. Co. (372–374)
Gump Co., B. F. (362–364)
Jeffrey Mfg. Co. (44A–45)
Sprout, Waldron & Co. (550 to 553)
Syntron Co. (311–313)
Titeflex, Inc. (281) absorption
Tyler Co., The W. S. (88)

WATER CONDITIONING EQUIPMENT

American Hard Rubber Co. (303–305) rubber lined
Illinois Water Treatment Co. (635)
Permutit Co., The (400)
Photoswitch, Inc. (603)
% Proportioneers, Inc. % (477–478)
Republic Filters, Inc. (556–557)
Roy Co., Milton (432–433)
Will Corp. (667–688)
Worthington Pump & Machy. Corp. (319–321)

(*Continued on page* 384)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

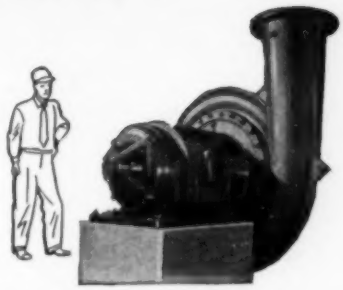
Handling Air or Gas?

ALLIS-CHALMERS BUILDS 5 TYPES OF EQUIPMENT FOR YOU!

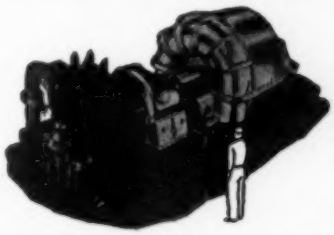
THAT MEANS we can engineer . . . *to your exact job requirement* . . . a blower, compressor or dry vacuum pump. Further, we are able to build it *standard or special* — whichever you need.

Allis-Chalmers experience in this field goes back half a century. Its engineers have fingertip acquaintance with many process problems and applications. The fact that A-C builds many varieties of high-speed rotating machinery is your assurance of air and gas handling equipment that will be *coordinated* with your drive and power requirements.

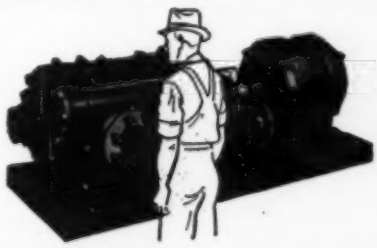
A *qualified* engineer in our nearby Sales Office is ready to discuss your future needs. ALLIS-CHALMERS, MILWAUKEE 1, WIS.



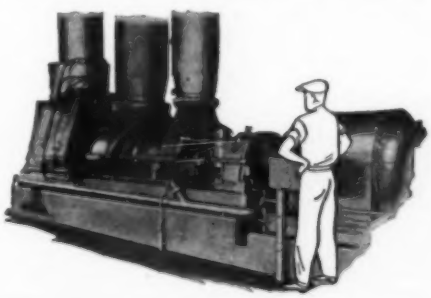
SINGLE STAGE BLOWERS Discharge nozzle can be arranged in any of 24 positions. Cast casing provides rigidity, longer life, smoother operation . . . deadens machine noises, eliminates vibration. Available in pressure ranges from one to 6.50 lbs.



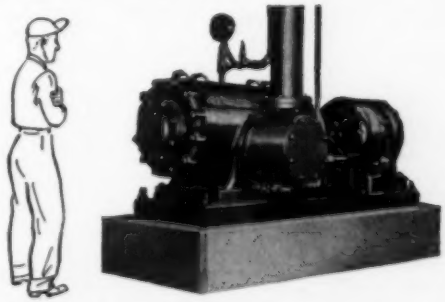
MULTI-STAGE BLOWERS Centrifugal type, for boosting, exhausting, circulating. Cannot build up dangerous pressures. Have enclosed backward-bladed impeller wheels. Pressure volume curve favorable to parallel operation. Inlet volumes to 130,000 cfm, air pressure to 35 lbs. gauge uncooled. Other ratings for special application.



ROTARY COMPRESSORS, sliding vane type. Air is compressed in cells formed by blades moving freely in and out of longitudinal slots in rotor eccentric to its casing. Quiet, smooth operation. Units start unloaded. Capacities for 5 to 35 psi-g.



AXIAL COMPRESSORS *Good base load machines.* Handle large fixed volumes of air with pressure variations over a comparatively long range. Used in connection with *gas turbines* and for high velocity wind tunnel operations. Able to compress to 60 lbs. gauge with high efficiencies. Cannot build up dangerous pressures.



DRY VACUUM PUMPS Same principle as rotary compressors with exception that inlet is hooked up to chamber to be evacuated and exhaust is open. No inside valves. Saves floor space. Range 2½ to 28½ inches hg. 52 to 5750 cfm, three to 250 hp.

A 2163

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

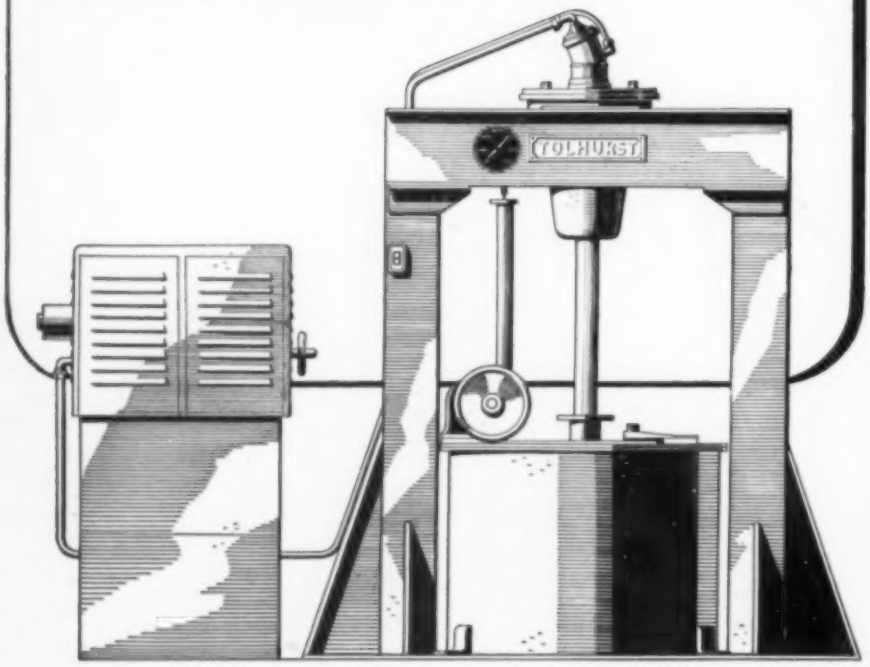
1847 1947 A CENTURY OF SERVICE to Industry THAT MADE America Great

At the Show...

21st EXHIBITION OF CHEMICAL INDUSTRIES
NEW YORK, DECEMBER 1-6

See Tolhurst's New

VARIABLE SPEED PILOT PLANT CENTRIFUGAL



- *Hydraulic Drive*
- *Basket Diameters 20" and 26"*
- *Centrifugal Force From 170 to 1700 Times Gravity*
- *Stepless Speed Variation From Zero to 2150 R.P.M.*
- *Drop-Bottom Case Permits Interchanging Perforate and Imperforate Baskets*
- *Ideal For Pilot Plants and Development Laboratories*

TOLHURST CENTRIFUGALS

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

Visit
OUR DISPLAY
BOOTHS 68-69
21st EXHIBITION
OF CHEMICAL
INDUSTRIES
DECEMBER 1-6

EXHIBITORS
Classified by Products
CONTINUED

WATERPROOFING COMPOUNDS
American Resinous Chemicals Corp. (35–36)
Davison Chemical Corp., The (622–624)
Electro Chemical Supply & Engr. Co. (81)
Koppers Co., Inc. (264)
Petroleum Specialties, Inc. (471)
Socony-Vacuum Oil Co., Inc. (324–326)
Sonneborn Sons, Inc., L. (471)
Titanium Alloy Mfg. Co., The (366–368)
U. S. Stoneware Co., The (89 to 91)

WATER SOFTENING EQUIPMENT
Allis-Chalmers Mfg. Co. (48–49)
Dorr Co., The (64–65)
Koven & Bro., Inc., L. O. (304–306)
Luzerne Rubber Co. (528–529)
Omega Machine Co. (480)

WAXES
Bareco Oil Co. (629–630)
Glyco Products Co., Inc. (225–227) synthetic
Petroleum Specialties, Inc. (471) paraffin, microcrystalline
Sonneborn Sons, Inc., L. (471)
Socony-Vacuum Oil Co., Inc. (324–326) microcrystalline, paraffin and special blends

WELDING EQUIPMENT
Allis-Chalmers Mfg. Co. (48–49)
Ampco Metal, Inc. (268)
Photoswitch, Inc. (603)
Willson Products, Inc. (419–420)

WIRE CLOTH
Baker & Co., Inc. (451–452) precious metals
Great Western Mfg. Co. (372–374)
Industrial Steels, Inc. (650) stainless steel
Newark Wire Cloth Co. (83–84)
Richmond Mfg. Co. (519)
Roebling's Sons, Inc., John A. (358–360)
Tyler Co., The W. S. (88)

WOOD FLOUR
Richmond Mfg. Co. (519)

Compiled from information supplied to International Exposition Company. No responsibility assumed for errors or omissions.

Visit
CHEMICAL
ENGINEERING
in Booth 42